Determinants of unemployment in CEE-10 economies: the role of labour market institutions and the macroeconomic environment in 2002–2012

Jurgita Pesliakaite

Bank of Lithuania

14. August 2015

Determinants of unemployment in CEE-10 economies: the role of labour market institutions and the macroeconomic environment in 2002–2012

Jurgita Pesliakaitė*

Abstract

The view that an institutional structure causes rigidities of the labour market is broadly accepted by policy makers. This assessment is conventionally based on unemployment theories that establish a linkage between labour market institutions and unemployment in the long run. Empirical research engages in investigation if the theoretical link between unemployment and labour market institutions could be proved to prevail. This paper provides an econometric analysis of determinants of unemployment in the long run in a set of Central and Eastern European countries for the period of 2002–2012. The evidence that institutional structure cause rigidities of the labour market and have direct effects on unemployment rate in these economies is found in this study. A set of non-structural indicators, accounted by macroeconomic shocks, also prove to have effects on the labour market outcomes. From a policy making perspective such implications suggest that structural labour market reforms and increases in the overall labour market flexibility in these economies is required to bring unemployment rates down.

Keywords: unemployment, labour market institutions, Central and Eastern European economies

Economics Department, Bank of Lithuania; e-mail: jurga.pesliakaite@gmail.com, jpesliakaite@lb.lt
Any errors that remain are my sole responsibility.

1. Introduction

High unemployment remains one of the main policy concerns in many Central and Eastern European countries. Factors determining its dynamics are thereby an important research area for the policy makers aiming to bring unemployment rates down. It is commonly agreed that institutional structure causes rigidities and influences labour market performance, but the importance of each labour market institution for the unemployment rate is a matter of empirical research.

This main purpose on this paper is to identify the factors that determine unemployment in the long run in selected Central and Eastern European (CEE-10) countries for the period of 2002–2012. Similar empirical studies that aimed to assess the problem of unemployment in a set of OECD and EU countries include, among others, Nickell (1997), Nickell *et al.* (2002), Blanchard and Wolfers (2000), Bassanini and Duval (2006) and the most recent - Orlandi (2012). The country panel in this paper consists of Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia and Slovenia. The motivation of the choice to analyse these countries all together is based on assumption that these economies have many common features in their economic development pattern since the early 1990's and all of them are new members of the EU. The interest to analyse CEE-10 economies arises also from the fact that these economies in general are exposed to high unemployment rate levels, usually higher than the ones in many OECD and EU member states. That naturally raises a question about the determinants of such high unemployment rates and the dominant factors that should be primarily targeted to reforms by policymakers aiming to bring unemployment rates down. A special focus in this study is given to Lithuania. In particular, it is analysed if there are substantial differences in the factors affecting unemployment in the long run in Lithuania in comparison to the remaining economies.

Analysis on determinants of unemployment starts by identification of the potential institutional factors that might have impact on the labour market outcomes in the long run. These indicators find their origin in the set of unemployment theories and are assumed to operate on unemployment rate by affecting demand for labour. The effect on labour demand goes either through the process in which unemployed are matched to job vacancies, or/and through excess wage claims on the market. Macroeconomic shocks, having the ability to partially capture the long run behaviour of the unemployment rate, extend the analysis on determinants of unemployment. The impact of those on unemployment goes mainly through the failures of the labour markets to adjust to the changing economic environment. Such failures, however, arise out of labour market inflexibility, which is usually originated by the labour market institutions.

The main role of empirical analysis on the topic is to investigate if the theoretical link between labour market institutions and unemployment in the long run could be proved to prevail. In empirical modelling, the so called non-accelerating inflation rate of unemployment (NAIRU) or non-accelerating wage rate of unemployment (NAWRU) often serves as proxies for unemployment in the long run. Econometric techniques also allow assessing the same problems by analysing annual unemployment rate figures. This paper, thereby, engages in exploring the latter data sets to assess unemployment problems in CEE-10 economies.

The main findings of this study is that labour market institutional indicators, commonly identified by theoretical models, fit well in explaining unemployment in the long run in CEE-10 economies. The role of macroeconomic shocks for labour market outcomes is also found to be important, although labour market institutions tend to over-dominate considerably the impact of the shocks on unemployment. These implications bring to the policy conclusion that implementation of the labour market reforms, primarily targeting specific labour market institutions, is crucial if reduction of the unemployment rate in economies is one of the main policy targets. In regard to Lithuania, no significant differences are found in comparison to the other economies analysed in this study.

The remainder of this paper is set out as follows. Section 2 presents theoretical background over determinants of the unemployment in the long run. Section 3 sets a simplified mathematical model based on a set of unemployment theories. Section 4 describes data and its sources as well as presents econometric model used to explain the evolution of unemployment rates. Section 5 provides empirical results for CEE-10 countries and section 6 concludes.

2. Theoretical framework: determinants of unemployment in the long run

The theoretical approach starts by listing a set of indicators that are expected to drive the long run unemployment rates. In this section of the paper such indicators are presented and theoretical linkage between those and unemployment is established.

Theoretical set-up starts by assuming that there are two key type indicators that determine unemployment in the long run: institutional or structural indicators and other or non-structural ones. Labour market institutions broadly affect the level of unemployment in two ways: by directly affecting the process in which unemployed are matched to job vacancies available, and/or by leading to excess wage claims regardless excess labour supply on the market. The linkage between wages and unemployment could be drawn straightforward: demand for labour is negatively related to wages, whereas unemployment rate itself moves to the opposite direction to labour demand. Such institutional indicators as unemployment benefit system, the level of unionisation in economy and wage bargaining conditions, degree of employment protection and labour taxation are the ones that are usually considered to be the most important in the literature on the determinants of unemployment in the long run. Non-structural indicators, broadly defined by a set of macroeconomic shocks, operate on unemployment usually through imperfections of the labour market. Wage rigidity or overall labour market inflexibility which, under many circumstances, is originated by institutional indicators leads to failures the labour market to adjust to these shocks and, in turn, has adverse effects on unemployment rate in economy. Non-structural indicators represented by change in productivity growth, shifts in labour demand and the real interest rate, thereby, have also power explaining long run (and short run) dynamics of unemployment rate. Both sets of the indicators along with their relation to unemployment rate are discussed more extensively in the sections below (Nickell *et al*. 2002; Orlandi 2012; Blanchard and Wolfers 2000; Saint-Paul 2004; Bassanini and Duval 2006).

2.1 Labour market institutions and unemployment

2.1.1 Unemployment benefit system

Generosity of unemployment benefit system is considered to be one of the most important institutional factors affecting unemployment in economy. The main mechanism through which long run unemployment rate is affected by benefits could be described by incentives to work. By providing income replacement, more generous unemployment benefit systems create a problem of moral hazard. Low net income gain obtained by exiting from unemployment into employment depresses incentives to work, as a higher reservation wage is requested in order to return to the labour market. Therefore a higher degree of income replacement, accounted by benefit replacement ratio,[1] is assumed to be a disincentive, as it encourages a prolonged stay in the unemployment pool, reducing job searching intensity and leading to a higher level of unemployment in the economy. Similarly, longer period of entitlement to receive benefits also creates a specific type of moral hazard to stay longer among unemployed[2] especially if, simultaneously, the benefit replacement ratio is high.[3]

Apart from the benefit replacement ratio and the time span of entitlement to receive benefits that affects incentives to work, several other aspects of the unemployment benefit system should be in addition considered. The coverage of unemployment benefit system and the strictness in which the system is operating are also of importance in this context. Such features of unemployment benefit system as monitoring of the job search, conditions that grants entitlement to receive benefits, conditions of termination or suspension of benefits payments and other administrative rules restricting entitlement towards unemployment social security fall under these aspects. These, again, are operating through incentives to work and are considered to be crucial in determining to which extent the generosity of the unemployment benefit system is actually affecting the level of unemployment in economy. This implies that the benefit replacement ratio and period of entitlement to receive benefits alone might not mean much for labour market outcomes on aggregate level if the coverage of unemployment benefit system is low and the system is strictly monitored (Holmlund 1998; Nickell *et al*. 2005; Bassanini and Duval 2006; Lauringson 2010; Stovicek and Turrini 2012).

[1] The benefit replacement ratio is defined as the ratio of the unemployment insurance benefit in respect to the total gross earnings lastly received by worker, i.e. the ratio is basically tied to previous earnings.

[2] There is support to the insight that outflow from unemployment into employment increases substantially at the end of eligibility period to receive income replacement (Holmlund, 1998)

[3] It is also profound that economies allowing longer eligibility periods to receive benefits also tend to have higher unemployment benefit replacement ratios (Borghijs *et al*. 2003).

2.1.2 Labour taxation

Generous unemployment benefit systems are disincentive and cause excess wage claims in order to return to the labour market, thereby, depressing labour demand and supply. Economic theories suggest that high labour taxes, accounted by the tax wedge,[4] also have a negative impact on the labour market outcomes. Its effect on unemployment goes mainly through the same, wage, channel.

Theoretically, the impact of labour taxes on unemployment might be assessed by analysing its effect on labour demand and supply curves in employment versus net wage framework. Here, introduction of labour taxation causes adverse shifts in either of these curves (usually labour demand), thereby, having a negative effect on employment in economy. Elasticity of labour demand and supply curves determines which of the curves shits because of labour taxation, whereas the elasticity itself might be straightforward paralleled with flexibility of the labour market or wage bargaining power of the labour market counterparts.

Employee and employer are considered to be the main labour market counterparts, but their behaviour in the wage setting process are highly influenced by trade unions and employer organisations. In the wage setting process, the negotiating power of all these groups is assumed to be crucial factor in determining the bearer of the tax wedge. If employees along with trade unions are lacking bargaining power,[5] entire tax burden would be passed on this labour market counterpart with no ultimate effect on unemployment rate. In this case, however, employees would be left with lower net wage. If, employees and trade unions, on the other hand, possess strong bargaining power, tax wedge would be shifted on employers, thereby, raising labour costs for the firms. In this case, due to net wage resistance, demand for labour would be negatively affected with eventual adverse effect on unemployment outcomes.[6] For any intermediate case where at least a part of the labour taxation would be passed onto employers, net wage resistance would result in adverse shifts in labour demand. However, latter cases sometimes are assumed to be a short run labour market outcome; in the longer run it is considered that entire tax burden is gradually passed on employees (Nickell 1997; Baccaro and Rei 2007).

A specific case when the argument of the net wage resistance is valid could be considered separately. Legislation of the net statutory minimum wages in economy implies that tax burden cannot be shifted onto employees because of the net wage floors. If, in this case, minimum wages are set above the market equilibrium level and if the coverage of the minimum wage receivers in economy is high, the adverse effects on labour demand and unemployment rate in such economies might be present (Nickell 1997; Baccaro and Rei 2007).

[4] It is defined as a ratio between total labour taxes – overall tax wedge – and total labour costs borne by employer. In the same manner it is also common to define this variable in absolute terms – as a difference between production wage which is labour costs of the firms and the consumption or net wage available for disposition for employees (Nickell *et al.* 2005; Bassanini and Duval 2006; Orlandi 2012)

[5] Lack of bargaining power of employees might not only be explained in terms of trade unions' and employer organisations' influence in the wage determination process, but also by within labour and capital mobility framework. If capital is internationally mobile whereas labour is not (or less mobile), all tax burden will be shouldered entirely by an employee. Firms in this case are unwilling to increase production wage if production resources – labour and capital – can be substituted by each other leaving employees with little of negotiating power (Nickell 1997).

[6] More specifically, all such effects could be considered as follows. If labour market is facing vertical (inelastic) labour demand curve, introduction of the tax wedge is going to be entirely borne by employer. In this situation no shifts in labour demand and supply curves would be observed having no ultimate effect on unemployment rate in economy. Net wages would remain unaffected, however, introduction of tax wedge would lead to the increased labour costs for employers. If, on the contrary, labour market is facing horizontal (elastic) labour demand curve, entire tax wedge would be shouldered by employee. Net wages would decrease with introduction of the tax wedge whereas demand for labour would remain unaffected having, again, no ultimate effect on unemployment rate in economy. Additional assumption of the vertical (inelastic) labour supply curve, however, is necessary in this case, otherwise decrease in net wage might depress labour supply in the formal sector of economy. In this sense heavy labour taxation would be harmful as it would lead to the increase of the shadow economy. For vertical (inelastic) labour supply curve, employees would bear tax burden again with no eventual effect on unemployment rate. In case of horizontal (elastic) labour supply curve, introduction of labour taxation would be shouldered by employer leading to unchanged net wage, increase in labour costs and decreased incentives to hire labour force. That would in turn cause downward shift in labour demand curve and have adverse effects on unemployment rate in economy. Any intermediate cases where at least a part of the tax burden is borne by employer would be harmful for employment. The overall impact of tax wedge on unemployment would be higher the more elastic labour demand function is. In the same manner, if taxation depresses labour supply, the effect of the tax burden would be more profound the more elastic labour supply curve is (Bassanini and Duval 2006; WB 2005).

2.1.3 Institutional structure of wage determination and collective wage bargaining

Apart from the bearer of labour tax wedge, trade unions also have ability to influence wages in economy in the other ways. It is considered that strong and influential trade unions might exert constant pressure on the wage growth above the market equilibrium level at the cost of higher unemployment rate. Just union power, however, is not enough to put pressure on wage growth; level of unionisation (or collective bargaining coverage) in economy and degree of coordination in wage bargaining process also matter. Generally, it is considered that higher union coverage along with strong union power presses wage growth up at a cost of lower employment, but, in practice, the effect of these aspects vary depending on collective wage bargaining system in economy. Higher coordination in the collective wage bargaining process across economy and across labour market counterparts dampens down excess wage claims and balances the negative effects of high union coverage and its strong power (Nickell 1997; Nickell *et al*. 2002; Nickell *et al*. 2005; Bassanini and Duval 2006; Baccaro and Rei 2007).

Wages can be bargained collectively at different levels of economy. These could be set at the firm, industry or regional level as well as economy as a whole. Wage bargaining occurring only at the half-centralised or intermediate levels of economy (i.e. industry and regional levels) leads to relatively high wages and, consequently, worst employment outcomes. The explanation to that is that wage determination occurring on this level is considered to be least coordinated and trade unions mind only a specific group of wage earners, thus negotiating wages above the market equilibrium level. This in turn leads to suppressed labour demand in specific sectors of economy and increase in unemployment rate. If, on the other hand, wages are collectively bargained at the lowest or highest levels of economy (i.e. at the firm and national levels), these strategies are regarded to be relatively employment-friendly. Decentralised or highly centralised wage determination process prevents excess wage claims and leads to the outcomes where wages are set at the level equal to or close to the market clearing level that would be achieved under perfect competition. In these wage bargaining processes, such risks as decrease in labour demand, job destruction and increase in unemployment rate, are taken into account when setting claims for wage growth.[7] Also in economies where unions lack of bargaining power, the level of unionisation is low and wages generally are not set collectively, the argument that institutional wage structure has an impact on unemployment, simply does not apply (Nickell 1997; Nickell *et al*. 2002; Nickell *et al*. 2005; Bassanini and Duval 2006; Baccaro and Rei 2007).

Under the category of institutional wage determination falls as well introduction of minimum wages in economy, thereby, being potential source for increase in unemployment rate. The latter argument applies only if minimum wages are set above the market equilibrium level and number of the receivers of the minimum wages in economy is high. The effect is also more harmful if minimum wages are set uniformly, i.e. no differentiation across age groups or different sectors of economy is present (Bassanini and Duval 2006; Nickell 1997).

2.1.4 Employment protection

Strong wage bargaining power of employees and their ability to shift a part of the tax burden onto employers can cause decrease in labour demand thereby rising unemployment rate in economy. Bargaining power yet might in many cases also depend on the other labour market structural indicator – strictness of employment protection legislation.[8]

In theory the impact of the strictness of employment laws on unemployment is very much inconclusive – its impact on labour market outcomes might go simultaneously from many different directions, thereby, having neutral overall impact on unemployment rate. Employment protection could affect labour market outcomes both directly, by influencing matching efficiency on the labour market, and indirectly, by possibly having effect on productivity and wage growth in the economy. Its direct effect could be summarised by acknowledging that more liberal labour protection laws might lead to the increase in outflows from unemployment, thereby, reducing unemployment rate. In this framework more generous

[7] It is considered that wage bargaining occurring at the lowest level of economy (i.e. at the firm level) prevents excess wage pressure. In this particular situation, labour market counterparts are aware of that excessive wage claims would have damaging effects on the firms' activity. High wages would lead to the increase in the labour costs, deterioration of competitiveness and loss of the market shares to competitors. That in turn would alter labour demand and lead to the job destruction. When wage bargaining, on the other hand, is occurring at the highest level of economy (i.e. national level), usually the involvement of governments in the process is present. Awareness that excessive wage pressure might have a negative impact on labour demand on the aggregate macroeconomic level also suppresses wage claims.

[8] In empirical research one of the most frequently used variables to measure such strictness is employment protection legislation (EPL) index. Methodology to calculate the index and summary indicators of employment protection for OECD countries is derived by OECD (2009, 2013) and might be found at http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm

employment protection increases the speed of filling in vacancies and thus results in a better matching efficiency. More liberal labour laws might, however, lead to the increase in turnover in the labour market in both directions. If employers are not bounded by labour laws (equivalently, to increase in hiring and firing costs), higher inflows into unemployment, might also be observed simultaneously, to the end, having no net effect, at best, on unemployment rate.[9] Although there is no obvious overall positive effect on unemployment, it is common that policy-making institutions are recommended to ease up employment protection laws. The reasoning behind this view is that even though the effect of employment protection on the unemployment rate is unclear, it still has real effects for the labour market outcomes. Liberalisation of the employment protection laws induces different dynamics in the labour market[10], thereby allowing it to adjust quicker in response to a variety of macroeconomic shocks and speed up the reallocation of the labour force in the changing economic environment. It is therefore anticipated that a higher degree of the liberalisation in any case influences labour market outcomes positively, although other structural reforms should be implemented simultaneously in order to make such policies effective (Nickell *et al*. 2002; Nickell *et al.* 2005; Baccaro and Rei 2007; Young 2003).

In literature it is also common to discuss some other channels through which employment protection might affect the unemployment rate in the economy. This effect steams indirectly, in particular, by influencing productivity and wage growth. It is considered that employment protection might have direct impact on the pay in economy as increase in bargaining power of the employees, resulted by stricter employment laws, might lead to increased pressure on wage growth. In the meantime, it is also argued that more restrictive labour law provides greater job stability. Long-lasting employment encourages cooperation between employees and enlarges investment into training that, in turn, might lead to the boost in productivity growth. Therefore, even though stricter employment protection presses up wages in economy, this increase might totally be offset by growth in productivity. Such a view, however, is not accepted by all. It is also argued that stricter employment protection laws might negatively affect growth in productivity. As a result of stricter laws, replacement of less productive staff with more productive workers is restricted and therefore might dampen down adjustment to the technological changes and slow down productivity growth in economy. In this particular situation, purely economic aspect of stricter employment protection regulation should not be ignored. It might be costly to dismiss unproductive employees as it rises hiring, firing and total labour costs for firms. Overall, the dominant effect of the employment protection on productivity and wage growth is inconclusive again (Nickell *et al*. 2002; Baccaro and Rei 2007; Young 2003).

2.1.5 Active labour market policies

Unemployment benefit system is supporting unemployed passively, by providing income replacement in case of job loss, whereas a number of other labour market policies are directed towards active assistance for unemployed. Active labour market policies are designed to counsel in a job-search process, provide education and vocational training or assist in job placement. Other programs directly subsidise employment (by for instance providing hiring subsidies for private sector, promoting self-employment or directly creating jobs in public sector) or even targets specific groups on the labour market (youth, long-term unemployed or disabled people). Such policies are linked explicitly to reduction of skill-mismatch in economy as any effort that leads to the enhanced skills and work experience makes it easier to match vacancies available with the stock of unemployed. Majority of such programs implicitly also lead to the decrease in non-wage costs for employers (mainly by reducing costs on training) which is intended to positively influence demand for labour. Active labour market policies, if efficiently designed, are thereby contributing to a lower long run unemployment rate in the economy; the efficiency of those policies also implies that no excess wage claims in economy should be observed.[11] The magnitude of the effect of programs on unemployment along with time horizon of the impact varies

[9] These conclusions are also supported by data – in reality countries having more restrictive labour market laws do not necessarily report higher unemployment rates than those having the liberal ones.

[10] In more liberal labour markets higher variability of employment and unemployment rates is usually observed. By encouraging hiring and firing processes, more liberal labour laws possibly also leads to the change in unemployment structure – by lowering long term and increasing short-term unemployment rates.

[11] For instance, provision of education and vocational training programs are effective only if they are relevant at the time and directly meet labour market needs whereas directly subsidised employment is effective only if a small group of unemployed is targeted. If active labour market programs are not designed in these ways, the implementation of them might harm the rest of economy and lead to economic inefficiency by generating deadweight losses, negative spill over or substitution effects. As an example for the deadweight losses would be creation of an excess amount of subsidised jobs even though these placements could be created in economy anyway. An example of spillover and substitution effect would be replacement of the nonsubsidized labour force with low-productivity workers that are entitled to subsidy. Also, policies lacking effectiveness and making participation in those more attractive than job taking (for instance financially), can lead to the increase in wage claims in economy (Bassanini and Duval 2006; Martin and Grubb 2001; Forslund and Kolm 2000).

depending on the type of policies and their individual efficiency (Nickell 1997; Bassanini and Duval 2006; Martin and Grubb 2001; Nickell *et al*. 2002; Orlandi 2012; Forslund and Kolm 2000).

2.1.6 Interactions between different labour market institutions

Labour market institutions separately are considered to have power to explain evolution of unemployment in the long run, but many of them also interact to each other. This was clear when, for instance, one considered the influence of the union power on the tax wedge resistance. Some other interactions between labour market structural indicators are also worth mentioning since one labour market institution might strengthen (or ease up) the impact of the other structural indicator on unemployment.

Thinking of for instance employment protection legislation, it is commonly reasoned that stringency of labour laws interrelates closest with wage bargaining conditions, tax wedge and unemployment benefit system. The linkage between employment protection and the former indicator was already discussed – stricter employment protection regulation strengthens wage bargaining power of those who are employed, possibly putting pressure on wage growth in economy. The effect of employment protection on the tax wedge resistance might be reasoned likewise – stronger wage bargaining power might cause labour tax wedge to be shifted onto employers. Legislation of statutory minimum wage in economy and labour tax wedge also interact straightforwardly – regulatory system might not allow tax wedge to be passed onto employees (Bassanini and Duval 2006; Young 2003). Interrelation between employment protection and unemployment benefit system somewhat differs. In this situation it is usually considered that there should be a trade-off between generosity of unemployment benefit system and stringency of employment protection. This implies that economies having stricter employment protection laws should aim to have less generous unemployment benefit ratio and opposite in order to keep labour market institutional structure effective and balanced between the labour market counterparts. The main idea behind this view is that stricter employment protection is supposed to reduce the risks for unnecessary involuntary unemployment whereas unemployment benefit system should provide some income replacement in case of job-loss, thus minimising the risks for employees (Chung and Jeong 2008; Young 2003).

Generosity of unemployment benefit system is considered not only to interact with employment protection, but also with the taxation burden in economy. As unemployment benefit system itself is financed by taxes, the more generous it is, the higher is the overall tax wedge in economy with possible implications on employment outcomes (Bassanini and Duval 2006). It is also considered that union coverage and power has an impact on the unemployment benefit system. Economies characterised by strong union power tend to have more generous benefit systems. Higher benefit replacement ratio and longer entitlement period to receive unemployment benefits usually are resulted by strong and powerful trade unions (Borghijs et al. 2003). As a structural indicator, passive unemployment policies also interact with active labour market policies. It is common that participants in the active labour market programs are also entitled for unemployment benefits. If efficiency of these policies is intended to be maintained, unemployment benefit system should be less generous (or strictly monitored) in order for it not to become disincentive for job-taking (Martin and Grubb 2001). The argument that active labour market policies are also financed by taxes and thus should interact with the tax wedge is also valid as it is in case with the generosity of unemployment benefit system. In this way any beneficial effects of active labour market policies should be weighed against the increase in tax wedge to finance these programs (Orlandi 2012; Bassanini and Duval 2006).

2.2 Non-institutional determinants and unemployment

2.2.1 Productivity shock

The role of permanent or long-lasting productivity shocks in the analysis of long run unemployment is to verify the fact that wage resistance has adverse effects on labour market outcomes. The starting point would be to assume that permanent deceleration in productivity trend growth[12] cannot be equally and swiftly accompanied with the fall in wage growth rate. As expectations for increase in wages do not adjust in line with the slowdown in productivity growth, unsustainable wage development in the economy might be observed for some period of time. In the longer perspective, full adjustment of the wage increase to the lower productivity growth is expected, but duration of the wage growth

[12] Primarily the reasoning relates to labour productivity growth (Nickell *et al*. 2005; Baccaro and Rei 2007).

deceleration to its new equilibrium level might be protracted. That is intended to depress labour demand and, hence, have adverse effects on unemployment rate in economy at least until full adjustment of the wages to this new environment is achieved. In the presence of productivity shock, wage rigidity originated by labour market institutions affects labour market outcomes similarly. The magnitude and persistency of the shock on unemployment in this case depends entirely on the degree of flexibility of the labour market. Temporary productivity shocks moreover have ability to explain the evolution of the cyclical part of unemployment rate (Orlandi 2012; Nickell *et al*. 2002; Bassanini and Duval 2006; Bertola *et al*. 2001; Nickell *et al*. 2002; Blanchard and Wolfers 2000).[13]

2.2.2 Labour demand shock

Less flexible labour markets might fail to adjust not only to productivity shocks, but also to other macroeconomic shocks hitting economy. In continuously changing economic environment persistent labour demand shock might give a rise to skill mismatch problem in economy. If, for instance, labour demand increases for workers attaining some specific skills against decrease for the other workers, unemployment rises within the latter group.[14] This in turn alters unemployment rate in economy as a whole. The labour market's inflexibility condition, however, is essential here. It assumes that labour supply for the newly required skills cannot simultaneously adjust to demand shock. The magnitude of the effect on unemployment depends on the degree of inflexibility of the labour market, whereas the time span of the effect - on the speed of adjustment of the labour force to the structural changes (Nickell 1997; Nickell *et al.* 2002; Nickell *et al.* 2005). Change in demand for skills is not the only one situation in economy giving a rise to labour demand shock. Any other structural change in economy might lead to similar effects. If an economy is switching from capital to labour-intense production techniques (or opposite), this alters labour share, demand for labour and consequently the overall rate of unemployment rate.[15] Also, cyclical fluctuations in labour share and thereby demand for labour could well explain temporary deviations of unemployment from its long run equilibrium rate (Orlandi 2012; Blanchard and Wolfers 2000; Bertola et al. 2001; Bassanini and Duval 2006).

2.2.3 Monetary policy shocks

It is also considered that there is a positive relationship between real interest rate – a summary measure of the cost of capital – and unemployment outcomes in economy. Longer lasting increase in the real interest rate is supposed to restrain investments and lead to capital under-accumulation. Accordingly, decline in employment is needed in order to restore the equilibrium capital-labour ratio. Restrictive monetary policy could therefore be seen closely related to the labour demand shock or even give an impulse to it.[16] The transmission of the increased interest rates on the unemployment rate could also be assessed by acknowledging that capital under-accumulation causes deceleration of the trend productivity growth and thereby a slowdown in the economic activity as a whole. Wage rigidity in this case, over again, lead to the failure of the labour market to adjust to the productivity shock causing decrease in the labour demand and increase in unemployment rate. The time span of the real interest rate shock in this particular case is in effect as long as wage growth adjusts to the changes in economic environment. As monetary policy measures also serves as a tool for cyclical stabilisation of economy, temporary fluctuations of the real interest rate captures also well cyclical

---

[13] Cyclical fluctuations usually cause temporary deviations of the productivity growth from its trend. In the beginning of crisis periods, labour productivity growth temporary decelerates, whereas wages might be frozen or their adjustment might delay. Rigid wages might lead to employment contraction in the later stages of crisis bigger than proportional to the cyclical effect and thus more profound hysteresis effect on unemployment rate in economy in after-crisis periods. Productivity shock thereby captures partially long run and partially short-run (cyclical) fluctuations of unemployment rate (Cunado and Alberiko 2012; Nickell 1997).

[14] As example for such situation might be increase in labour demand for high-skilled against decrease in demand for low-skilled workers, conditioned on that demand for low-skilled workers, due to some other economic reasons factors, is not increasing simultaneously. This is a standard situation giving a rise for skill mismatch (Nickell 1997).

[15] The interaction between labour share and labour demand shock is derived mathematically by Blanchard and Wolfers 2000 from the simple Cobb–Douglas production function. Letting the aggregate production be denoted by $Y = AL^{\alpha}K^{1-\alpha}$, the marginal product of labour input is equal to $Y_L = \alpha\frac{Y}{L}$. Assuming further that imperfections of the labour market can cause divergences (μ) between real wages (w) and marginal product of labour (Y_L) , the equilibrium income labour share in economy can be defined as $a = \frac{wL}{YP} = \frac{\mu Y_L L}{YP} = \mu\alpha$, where $\mu \equiv \frac{w}{Y_L}$. In this case, for $\mu = 1$ the market would be under perfect competition (i.e. $w = Y_L$) and for $\mu \neq 1$ – otherwise (i.e. $w \neq Y_L$). Income labour share a in accordance to this representation increases either with increase in μ or/and increase in α. Increase in α might be associated with an increase in the weight of the labour as production factor in economy that in turn causes increase in labour demand. That is likely to happen if, for instance, economy is moving towards labour intense production. Increase in μ might be associated with the increase in the gap between real wages and marginal product of labour, having a negative effect on labour demand. Changes in the income labour share might therefore signal for the labour demand shock in economy; however, the reasons of the change should be evaluated carefully (Blanchard and Wolfers 2000; Bassannini and Duval.2006).

[16] In addition Nickell *et al.* 2002, Baccaro and Rei 2007 considers the case when increase in real interest rate leads to the increase on the returns of non–human wealth. This in turn raises reservation wage requirement, leads to the increase in the labour costs and therefore triggers a negative labour demand shock.

position of economy and thereby short run deviations of the unemployment rate from its long run level (Bertola *et al*. 2001; Orlandi 2012; Blanchard and Wolfers 2000; Bassanini and Duval 2006).

2.2.4 Labour supply shocks

Apart from labour demand, labour supply shocks should also be considered in the analysis of unemployment.[17] Labour supply measures, such as for instance introduction of early retirement schemes or reduction in hours worked, are conventionally considered by policy-makers aiming to reduce unemployment rate in economy. However, it is argued that supply side measures do not help to increase employment. Unemployment rate in economy is entirely determined by real labour demand and the effect of supply side measures, given existing institutional structure, tend to diminish in both short and the long run. Labour demand tends to adjust to any labour supply shock through wage correction thus leaving unemployment rate in the long run unaffected (Nickell 1997; Nickell *et al*. 2002; Ball 1999; Orlandi 2012).[18]

3. Mathematical framework: determinants of unemployment in the long run

Labour market institutions that have impact on the labour market outcomes in the long run find their origin in a set of unemployment theories. Short run behaviour of the unemployment rate could be explained by temporary fluctuations of demand for labour which, as noted in previous sections, partially is captured by a set of macroeconomic shocks. This section of the paper develops the mathematical framework for the determinants of unemployment rate in the long run. The model is consistent with the general wage rule approach based on the either neoclassical, wage bargaining or efficiency wage models or a mixture of those. Here, labour demand l_t, derived from the typical firm's profit maximisation behaviour, is given by

$$w_t - p_t = y_t - l_t + x_t, \tag{1}$$

and is positively related to the output, y_t and negatively – to real wages, $w_t - p_t$. Equation (1) determines the wage that firms are willing to pay employees given the level of productivity, $y_t - l_t$, alternatively, the marginal product of labour that firms expect from employees for given real wages. The remainder term, x_t in equation (1) represents any shock to the labour demand equation.

Employees' perception on real net wage is given by the wage curve

$$w_t - p_t^e - \tau_t = a_0\, ud_t + (1-\mu) b_t^e + \mu pr_t^e - \beta u_t + a_t^w, \tag{2}$$

where on p_t^e denotes expected price and τ_t – labour taxation. On the right hand side of equation (2) b_t^e stands for expected reservation wage, pr_t^e – for expected productivity. u_t is unemployment rate in economy, ud_t denotes union density and a_t^w is a shock term to the wage rule (or a supply side shock). Equation (2) summarises that employees negotiate wages at time t depending on the price level expectations, current unemployment rate, expected productivity and expected reservation wage. In this representation, for $\mu = 0$, employees' wage perception is consistent with the neoclassical and, to some extent, efficiency wage approaches as wage claims are not linked to productivity and are set to be equal to reservation wage, b_t. Labour taxation, τ_t, added to equation (2), would be directly linked to increase in wage claims, or more precisely, amount of taxes would equally raise the reservation wage, b_t. Also, in this type of atomistic labour markets with no bargaining power of employees and trade unions, the term representing union density, ud_t, would approach zero. For $\mu = 1$, the wage curve collapses to wage bargaining framework where wage is related to expectations about productivity development, pr_t^e. In this set up, in order to ensure the appropriate net wages, labour taxation, τ_t, would be directly linked to the productivity indexation rule and employees together with unions, ud_t, would try to shift taxes onto firms. An intermediate case of $0 < \mu < 1$, could occur if aggregate labour markets are exposed for any kind of segmentation.[19]

Turning back to equation (1), the shock x_t entering labour demand function could be divided into its long run and transitory components, $x_t = x_t^* + \rho_t$, where x_t^* would denote the long run effect of the macroeconomic shocks on

[17] A variety of other macroeconomic shocks, such as for instance deterioration in the terms of trade, shock in inflation, change in central bank dependence index and others have also gained some interest in empirical literature within the topic of evolution of unemployment (Bassanini and Duval 2006; Baccaro and Rei 2007)

[18] For instance, introduction of early retirement schemes implies that labour supply in economy is reduced. As labour supply shrinks, wage pressure in economy arises which is conventionally offset by cut in jobs and decrease in labour demand. Imposing cut in hours worked leads to analogous effects on the labour demand unless wages decrease in line with cut in hours worked.

[19] Broader discussion on the assumptions of different theories could be found in D'Auria et al. 2010, Orlandi 2012.

unemployment. x_t could also be represented by either active labour market policies, $x_t^1 = \varphi_1 ap_t$ or by employment protection legislation $x_t^2 = -\varphi_2 epl_t$. Inclusion of these terms could be interpreted in two ways. Firstly, active labour market policies reduce non–labour costs for employers, $w_t - p_t - \varphi_1 ap_t$, whereas employment protection laws might lead to increase in labour cost of the firms, $w_t - p_t + \varphi_2 epl_t$. Secondly, these shocks might be partially internalised by employees and, in the case of active labour market policies, lead to increase in productivity, $y_t - l_t - \phi_1 ap_t$ or increase/decrease in productivity for employment protection term, $y_t - l_t \pm \phi_2 epl_t$. ϕ_1 and ϕ_2 denotes the internalised fractions of the terms. Inclusion of these additional terms, lead to the productivity equation of

$$pr_t = y_t - l_t + \phi_1 ap_t \pm \phi_2 epl_t. \quad (3)$$

The reservation wage is given by

$$b_t = b_t^0 + y_t - l_t - \theta t_t, \quad (4)$$

where b_t^0 stands for unemployment benefit ratio. It is also allowed the reservation wage to affected by the fraction of labour taxation labour θ, where $\theta \in (0,1)$, that is borne by employees and by labour productivity, $y_t - l_t$. Assuming also that there are no expectation errors, i.e. $b_t^e = b_t$, $p_t^e = p_t$, $pr_t^e = pr_t$, unemployment in the long–run is derived from the system of equations and given by

$$u_t^* = \frac{[a_0 ud_t + (1-\mu) b_t^0 + \tau_t (1 - \theta(1-\mu)) - ap_t(\varphi_1 - \phi_1) + epl_t(\varphi_2 \pm \phi_2)]}{\beta}. \quad (5)$$

Here, unemployment is positively related to unemployment benefit ratio, union density and labour taxation whereas negatively – to active labour market policies. The effect of employment protection might go in both directions. Importantly, for μ being close to unity, the parameter θ would approach zero. This would imply that the entire tax wedge is borne by employer with negative effect on unemployment rate. Oppositely, for μ being close to zero, θ converges towards unity, implying that entire tax burden is passed onto employees with no tax wedge effect on labour market outcomes (D'Auria et al. 2010; Orlandi 2012).

4. Data description and empirical framework

This section of the paper aims to present data used to analyse the determinants of long run unemployment in CEE–10 economies. The panel consists of: Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia and Slovenia. The countries included in the panel have shown similarity in their development pattern since early 1990's and all of them are new EU member states. Sample size is restricted by data availability and covers the period of 2002–2012. In the last subsection, empirically tested models are established and presented.

Time series for dependent variable – unemployment rate – is plotted in the figure A.1 in Appendix A. Labour market structural indicators used in the baseline estimations for the countries under consideration – labour tax wedge, unemployment benefit ratio and public spending on active labour market policies – are plotted against unemployment in the figures A.2–A.4. The choice of indicators in the baseline model is determined by data availability. Deviation of the labour share from its mean in construction sector, labour productivity growth and deflated 10-years interest rate are used as proxies for macroeconomic shocks. Their graphical representation is available in Appendix 1 in figures A.5–A.7. Table A.8 in Appendix A also provides descriptive statistics for all these variables. Both structural and non-structural indicators are time varying. The motivation of the choice of such proxies in the analysis of unemployment in the long run, measurement of those, their expected signs in regressions and data sources are described more extensively in the sections below.

4.1. Measurement of unemployment rate

The dependent variable, the aggregated unemployment rate is calculated as a share of unemployed persons to the labour force. Data for the analysed CEE-10 countries is gathered from Eurostat database. The average unemployment rate refers to the 15–74 age groups (Orlandi 2012; Bassanini and Duval 2006).

4.2. Baseline model: measurement of structural indicators and data sources

In regard to labour market structural indicators, labour tax wedge is expected to have a negative impact on employment outcomes, i.e. increase in it should go along with the increase in unemployment rate in economy. Initial time series of the tax wedge for different groups of earners and different family types for the set of European economies is derived by European Commission and is calculated as a ratio (in percent) between the sum of labour taxes and total labour costs carried by employer. Particularities of the European tax system are also taken into account to calculate these variables.[20] The average labour tax wedge indicator for each individual CEE-10 economy is taken over four different income groups and three different family situations (Nickell 1997; Bassanini and Duval 2006; Orlandi 2012).[21]

Unemployment benefit ratio is a variable that serves for a proxy for the overall generosity of the unemployment benefit system.[22] It is also expected that an increase in the benefit replacement ratio should have a negative influence on employment, i.e. a rise in it should be accompanied with an increase in unemployment outcomes. Initial data on replacement rates for different income groups, family types and different duration periods can be found in European Commissions' database and are calculated as ratios (in per cent) of unemployment insurance benefit to the total gross earnings received by employee before outflow from employment (Nickell 1997; Bassanini and Duval 2006). Benefit replacement ratios over five different income earner groups and three different family types are considered in the calculations of country's unemployment benefit ratio averages for CEE-10 economies. It is noteworthy that only the replacement rates for the first year of unemployment form here the average unemployment benefit ratio.[23] The reason for this choice concerns the particularities of the CEE-10 unemployment benefit systems when the eligibility period to receive unemployment benefits does not exceed one year for all analysed countries. The alternative indicator, denoted as the average net replacement ratio (in percent), is also calculated and used in some specifications of empirically tested models. It is calculated as the average across five different income earners groups, three different family situations, and moreover it takes into account unemployment benefit duration periods exceeding one year.

The variable representing the spending on active labour market policies (ALMP) is defined as public expenditure aggregate on active labour market programs as a share of GDP (in per cent). It is expected that ALMP, if effective, should have a positive impact on employment, i.e. increase in it should go along with the decrease in unemployment rate in economy. Spending on ALMP aggregate consists of labour market services performed by public employment institutions including their administration, labour market training, supported employment and direct job creation within the public sector as well as start-up and employment incentives. Disaggregated data for CEE-10 countries is gathered from Eurostat. The additional indicator denoting ALMP, also often used in empirical research to analyse unemployment, is calculated as public spending on ALMP per unemployed person as a share of GDP per capita (in percent) and, in this paper, is used in alternative models (Orlandi 2012; Bassanini and Duval 2006; Nickell *et al.* 2002).

4.3. Additional models: measurement of structural indicators and data sources

A set of additional structural indicators, which are considered having an effect on unemployment rates in the long run in CEE–10 economies, are described in the section below. These variables represent: union density, coordination in wage setting process, minimum wages and employment protection legislation index. The motivation for not including these indicators to the baseline equation (except for minimum wages) is usually poor data availability. Thereby, with these variables, only the alternative models are estimated, however, on extensively reduced sample sizes.

Union density is usually used as the simplest proxy to denote collective wage bargaining coverage or, more generally, wage bargaining conditions in the economy. Although, the former variable, per definition, defines only union coverage

[20] Formally labour tax wedge for European economies is calculated as $LTW_t = (PIT_t + SSC_t^F + SSC_t^E)/TLC_t$. Here PIT_t and SSC_t^E represents personal income tax and social security contributions paid by employee respectively during the reference year, both deducted from the gross wage. SSC_t^F embodies the social security contributions bore by employer and paid as additional amount on the gross wage. TLC_t represents in turn total labour costs (production wage) consisting of gross wage plus social security contributions carried by employer.

[21] Different income groups are represented by employees earning 50%, 67%, 100% and 167% of the average wage (AW). Different family types accounts for single persons, single earner couples with 2 children and 2 earner couple with 2 children.

[22] The variable representing benefit duration period (in months) is in addition used in alternative estimation procedures of this study. It enriches the analysis of how the overall generosity of unemployment benefit systems affects unemployment in the long–run.

[23] In particular the average is calculated from 2 and 7 months unemployment benefit replacement rates.

rate (in percent) as well as, to some extent, the power of the trade unions, it might serve as the simplest proxy for the whole institutional structure of wage determination in an economy.[24] In general cases, higher union density is expected to go along with decrease in employment, i.e. increase in their density should cause increase in unemployment rate. In cross-sectional data analysis it is also common to use the index representing the generosity of collectively wage bargaining system. Such index would account for the level of economy at which wages are bargained, thus, possibly providing some additional information the evolution of unemployment in economy. The construction of such an index might also be of importance in a single country analysis if an economy is switching among collective wage bargaining levels (Nickell 1997; Bassanini and Duval 2006; Orlandi 2012). Some simpler representation of such an index might be a degree of coordination in wage setting process. This index would range between values from one to five, suggesting that, in the presence of the trade union in economy, higher degree of coordination should, in general, be more generous for unemployment outcomes. In regard to CEE-10 countries, the latter index along with union coverage rate is used only in the alternative representations to the baseline regression. Decision not to include these two variables to the baseline model is poor data availability for CEE-10 economies and small sample size which is expected to lead to decreased result reliability. Available data for union coverage is gathered from OECD database. The index representing degree of coordination in wage setting process is calculated by ICTWSS.

Wage bargaining occurring at the national levels of economies in form of statutory minimum wages is also considered in the analysis, because it might cause wage resistance. Alternative models to the baseline equation thereby assess the impact of minimum wage on unemployment in the long run. The appropriate measure is calculated as a ratio of minimum wage to the average earnings in business economy (in per cent). This proxy is also known as the so called "Kaitz index" and is taken from Eurostat database. It is expected that the minimum wage, set above the market equilibrium level, might have a negative impact on employment outcomes, i.e. increase in it might be associated with the increase in unemployment rate in economy (Nickell 1997; Bassanini and Duval 2006).

Employment protection legislation (EPL) index is often used as a proxy to measure flexibility of the labour market. The methodology to derive EPL index is developed by OECD and estimates of it could be found in OECD database.[25] The data on EPL index for CEE-10 countries is poor (in terms of data availability), thus, this measure is used only in alternative model to the baseline equation. EPL sub-indexes – employment protection for regular contracts (EPRC) and employment protection for temporary contracts (EPT) – are used in this paper to assess impact of employment protection on labour market outcomes in CEE-10 economies whereas, as discussed in the theoretical part, the impact of the stringency of labour laws on unemployment is inconclusive (Nickell 1997; Bassanini and Duval 2006; Venn 2009). [26]

4.4. Measurement of non-structural indicators and data sources

Three macroeconomic shocks, namely: productivity, labour demand and real interest rate shocks, are used to extend analysis on determinants of unemployment in CEE-10 countries. Each of these shocks is used in the baseline equation as well as in alternative models and captures partially cyclical and partially structural behaviour of unemployment rates in economies.

The productivity shock is calculated as the growth in labour productivity (in per cent), which is approximated by the difference between real GDP and employment growth rates. Initial data for these indicators could be found in Eurostat. Deviations of the productivity growth from its trend or changes in productivity growth could be used as alternative proxies

[24] Formally union density it is calculated as $TUD_t = UM_t/TPM_t$, where TUD_t represents trade union density. UM_t denotes total union members in economy TPM_t– total number of employees. The variable representing total union members in economy also successfully can be replaced with the number of employees covered by collective wage bargaining agreements (Nickell *et al.* 2002; Orlandi 2012).

[25] Calculation of EPL index for Lithuania is performed by the Bank of Lithuania.

[26] More specifically, EPL index consists of three major sub-indexes, thereby the summary indicator, EPL, is calculated from these sub-indexes by applying specific weights to them. The first EPL sub-indicator embodies protection of employees working under regular contracts, the second one – depicts the specific requirement on collective dismissals and the third one – evaluates the strictness of the regulations on temporary forms of unemployment. Employment protection for regular contracts (EPRC) aggregates the first two sub-indicators and is often used in empirical literature as the main measure characterising the level of liberalisation of the labour market. The other – employment protection for temporary contracts (EPT) – index incorporates the last one of the EPL sub-indicators and might give addition insights on how flexible employment forms affect the evolution of unemployment in economy. However, usage of EPT index as proxy to measure flexibility of the labour market is limited, because, in many economies, the coverage of the temporary contracts on the labour market is low.

to describe productivity shock (Bassanini and Duval 2006; Orlandi 2012; Nickell *et al.* 2002; Baccaro and Rei 2007). The reason to use labour productivity growth as a proxy in this particular situation is basically based on the data availability for CEE-10 economies. In accordance to economic theory decrease in growth in productivity should go in line with increase in unemployment rate and this shock, per construction, is assumed to capture both long and short run behaviour of unemployment rate.

Evolution of the labour share in the construction sector is considered to serve as a proxy for labour demand shock. Labour share in construction is measured as a ratio of the employees in this sector to the total employees (in per cent). Initial data for these indicators is gathered from Eurostat database. The variable is calculated as its deviation from the mean.[27] The basic motivation behind the choice of the labour share in construction sector as a proxy for the labour demand shock variable is its straightforward interpretation. Construction sector usually is very sensitive to business cycle fluctuations. Thereby, evolution of this variable, calculated as deviation from the mean, captures well cyclical behaviour of economy as well as sensitivity of unemployment to cyclical fluctuations. Permanent increase in the labour share in construction would, for instance, point towards increase in labour intense production techniques, thereby, structural shifts in economy would also, at least partially, be accounted by this variable (Orlandi 2012).[28] By using this variable as a proxy for the labour demand shock, it is expected that an increase in the labour share should be associated with the decrease in the unemployment rate and opposite.

Long-term real interest rate is used as a proxy for the real interest rate shock. In particular, real interest rate time series (in per cent) are constructed taking the difference between the nominal long run government bond yield (with approximate maturity of 10 years) and the annual change of GDP price inflation (Blanchard and Wolfers 2000; Bassanini and Duval 2006; Orlandi 2012). Data for these variables is gathered from Eurostat database (except for Estonia).[29] Economic theory points to the conclusion that increases in the interest rate level in economy is supposed to be in line with lower employment and thus increase in unemployment rate in economy. Real interest rate shock accounts for both cyclical fluctuations and structural shifts in unemployment rate occurring in the economies.

In addition to those shocks, output gap is used in alternative models to the baseline equation to replace three other – productivity, real interest and labour demand – shocks. The output gap, however, captures entirely cyclical behaviour of unemployment rate. It is assumed to be negatively related to the evolution of unemployment, i.e. a positive output gap would be associated with the decrease in unemployment and opposite.[30] This variable for CEE–10 economies is calculated for each country separately as a gap (in per cent) between actual and potential output series as a ratio of the potential GDP by the means of Hodrick-Prescott filter (smoothening parameter λ=100) (Bassanini and Duval 2006; Baccaro and Rei 2007). Historical real GDP time series along with forecast to 2015 are extracted from AMECO database.

4.5 Econometric model: baseline equation and alternative models

The baseline equation for the multiple country analysis includes a part of potential structural determinants of unemployment rate along with macroeconomic control variables. In the baseline equation no interdependence between structural indicators are considered. Empirically tested baseline model is intended to explain past unemployment trends and in static form is designed by using simple individual and time-specific fixed-effects model as follows:

$$u_{it} = \sum_j \beta_j X_{it}^j + \sum_j X_j Z_{it}^j + \alpha_i + \lambda_t + \varepsilon_{it}, \quad (6)$$

[27] Country–specific means are calculated for the period 1999/2000–2013. Cyclical component of detrended series of the same variable could serve as an additional proxy for labour demand shock. In order to detrend the series with HP filter though requires future forecasts which are not available for this particular variable.

[28] In some empirical research, it is considered that majority of the variables representing shocks (with some exceptions for the real interest rate) captures purely cyclical part of unemployment rate. The reason to it is that is these shocks by construction are usually mean-reverting variables (Baccaro and Rei 2007). Similar reasoning was applied in the theoretical part, noting that the effect of the macroeconomic shocks on unemployment diminishes after some time (Blanchard and Wolfers 2000). However, as the time span for mean-reverting process might be prolonged, macroeconomic shocks also have power to explain the evolution of the long run unemployment rate even through hysteresis effects.

[29] For Estonia, data for the nominal long run interest rate is gathered from the Bank of Estonia statistical database. It accounts for interest rate paid for the long-term (5–10 years) loans, denominated in euro, to non-financial corporations.

[30] Cyclical behavior of unemployment and its negative relationship to the output gap would also indirectly signal for a typical short term Phillip curve trade-off between changes in inflation (through cyclical conditions of economy) and unemployment rate in economy (Baccaro and Rei 2007).

where u_{it} is unemployment rate at time t for country i, X_{it}^{j} accounts for labour market institutional variables for country i whereas Z_{it}^{j} denotes observed macroeconomic shocks. α_i is individual-specific fixed-effects, capturing country specific and time-invariant unobservable shocks and λ_t is time-specific fixed-effects which serves as a proxy for time-varying common unobservable shocks affecting all countries simultaneously (Bassanini and Duval 2006; Orlandi 2012).[31] Regarding labour market structural indicators, X_i^j include labour tax burden, unemployment benefit system and active labour market policies in the baseline model. In alternative representations, X_i^j is augmented with minimum wages, union density, employment protection legislation and some other variables that are assumed to have additional power to explain unemployment rate in CEE-10 economies Z_i^j in equation (6) represents labour productivity, labour demand and real interest rate shocks. Occasionally some alternative models where these shocks, replaced with the single variable – the output gap – are also estimated. In this type of regressions, where all labour market indicators are expressed in percentage form, the magnitude of significant estimated coefficients would indicate the impact on unemployment rate of a one percentage point change in structural and non–structural indicators.

4.6 Econometric model: equations with policy interactions

In addition to the baseline model, augmented models, usually with one interaction term between labour market structural indicators, are also estimated and takes the general form of:

$$u_{it} = \sum_j \beta_j X_{it}^{j} + \gamma_{kh}\left(X_{it}^{k} - \bar{X}^{k}\right)\left(X_{it}^{h} - \bar{X}^{h}\right) + \sum_j X_j Z_{it}^{j} + \alpha_i + \lambda_t + \varepsilon_{it}, \qquad (7)$$

where the additional term $\gamma_{kh}(X_{it}^{k} - \bar{X}^{k})(X_{it}^{h} - \bar{X}^{h})$ denotes the interaction term between labour market institutional indicators. $\bar{X}^{k}$ and $\bar{X}^{h}$ are the sample means of the structural indicators X_{it}^{k} and X_{it}^{h} respectively. Thereby, interactions are usually expressed as a product of the relevant variables, i.e. in multiplicative terms, whereas variables themselves are calculated as their deviations from the mean. Significance of the coefficients γ_{kh} in type (7) augmented regression would provide economical evidence that complementarity of reforms X_{it}^{k} and X_{it}^{h} do matter (Bassanini and Duval 2006; Baccaro and Rei 2007).[32] Theoretically possibility of such interactions was considered in theoretical part of this paper, whereas interpretation of the concrete interaction terms would be discussed more extensively by presenting results of the estimations in the sections below.

[31] Correctness of this specification is tested with appropriate tests.

[32] Also, this intuition could be proved mathematically. Partial derivatives of equation (7) with respect to X_{it}^{k} and X_{it}^{h} are expressed as $\frac{\partial u}{\partial X^{k}} = \beta_k + \gamma_{kh}(X_{it}^{h} - \bar{X}^{h})$ and $\frac{\partial u}{\partial X^{h}} = \beta_h + \gamma_{kh}(X_{it}^{k} - \bar{X}^{k})$. This implies that, for example, obtaining $\beta_k > 0$, $\beta_h > 0$ and $\gamma_{kh} < 0$, higher values of X^h would be associated with lower values of the partial derivative $\frac{\partial u}{\partial X^{k}}$. In the same sense, higher values of X^k would be associated with lower values of the partial derivative $\frac{\partial u}{\partial X^{h}}$. Economical intuition in this case would suggest that for higher values of X^h (or X^k), the impact of X^k (or X^h) on unemployment would be lower and the opposite. In the other words, the impact of X^h (or X^k) would be diminishing, i.e. would be more employment friendly, if the value of X^k (or X^h) at same time is rising. This proves the importance of complementary reforms if one intents to minimize the adverse effect of some labour market structural indicator on unemployment (Bassanini and Duval 2006).

5. Determinants of unemployment: discussion over results and policy implications

This section of the paper presents and discusses the results on determinants of unemployment in CEE-10 countries. In the last subsection estimation results of this study are also compared to the similar works, which analyse problems of unemployment in EU-13 and OECD-21 economies.

5.1 Results from the baseline equation

The baseline equation is estimated with simple panel individual-specific and time-specific fixed-effects model. Here, the annual unemployment rate is regressed on three institution labour market indicators – labour tax wedge, unemployment benefit replacement ratio and active labour market policies-to-GDP ratio and three non-structural variables.[33]

Table 1 reports results of the estimations; all variables, if significant, are correctly signed. Column (1) relates to the partial model where only labour market structural indicators are considered; column (2) – to the partial model where unemployment rate is regressed only on a set of macroeconomic controls. These models serve mainly for coefficient stability checking. Column (3) reports results from favoured equation with both structural and non–structural indicators included in the model. Column (4) considers dynamic model with lagged dependent variable. Here, the difference GMM Arellano-Bond one-step estimator is employed for robustness check of the results for the baseline regression.[34] Columns (5) and (6) present alternative models on determinants of unemployment rate where majority of institutional explanatory variables (except for labour tax wedge) along with macroeconomic controls as in (6) are replaced by alternative indicators. With these setups, it is tested whereas redefinition of the majority of variables affects results of the baseline model.

Table 1. Unemployment equation, 2002–2012

			Baseline equation	Robustness check	Alternative models	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects	Panel individual- and time-specific fixed-effects	GMM Arellano-Bond one-step estimator	Panel individual-specific fixed-effects	Panel individual-specific fixed-effects
	Reduced static model: structural indicators only	Reduced static model: macroeconomic shocks only	Static model: baseline equation	Dynamic model	Static model: with alternative structural variables	Static model: with alternative structural variables; gap version
Unemployment (–1)				0.15 (0.17)		
Labour tax wedge	0.49 (0.17)***		0.35 (0.11)***	0.40 (0.18)**	0.26 (0.13)*	0.21 (0.11)*
Unemployment benefit ratio – 1st year of unemployment	–0.02(0.06)		–0.02 (0.05)	–0.02 (0.06)		
Net replacement ratio					–0.01 (0.10)	0.04 (0.08)
Active labour market policies	–4.92(2.58)*		–4.56 (2.30)*	–5.06 (2.33)**		
Active labour market policies (alt)					–0.28 (0.09)***	–0.25 (0.06)***
Labour demand shock		–1.44 (0.18)***	–1.33 (0.20)***	–1.38 (0.32)***	–1.79 (0.34)***	
Productivity shock		–0.07(0.08)	–0.08(0.08)	–0.18 (0.08)**	–0.04 (0.08)	
Real interest rate shock		0.08 (0.03)**	0.09 (0.04)**	0.06 (0.03)*	0.08 (0.03)**	
Output gap						–0.38 (0.02)***
Trend					0.25 (0.13)**	0.26 (0.07)***
Fixed effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	no	no
R-squared	0.84	0.89	0.92		0.84	0.91

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels respectively; Cross-section (PCSE) standard errors are used to control for panel heteroscedasticity; Necessity for individual specific fixed-effects and time-specific fixed-effects, if included, is tested with redundancy test in models (1)–(3); In baseline static models (1), (2) and (3) country specific trends for Poland, Slovakia and Czech Republic are included in estimations. These account for country specific unidentified shocks, are used for residual correction and chosen due to their significance in equations; in models (5) and (6) a linear trend has been added to the estimations. It captures common unobservable shocks for all countries with similar pass through effect on unemployment rate (Orlandi 2012); For any interaction terms included, both variables are expressed as their deviations from country-specific sample means (Bassanini and Duval 2006; Nickell *et al.* 2002); In the difference GMM Arellano-Bond one step estimator procedure lagged endogenous variable in levels and all explanatory variables are used as instruments in estimation.

[33] Appendix B reports unit root test results.

[34] The motivation for the choice of GMM is that simple panel individual and time-specific fixed-effect methods lead to inconsistent estimates when dynamic models with lagged dependent variable are considered. GMM estimation procedure solves these particular problems.

The main results are listed as follows. The effect of the labour tax wedge on unemployment varies around 0.4–0.5 as accounted by estimates presented in columns (1)–(4) of Table 1; the impact of this variable, as expected, appears to be statistically significant in all these models. Such results supports insights of economic theory about tax wedge resistance in CEE-10 economies, however, the source of it cannot be identified from these representations. Turning to spending on the active labour market policies, these also appear to have significant impact on unemployment outcomes, in particular, by effectively reducing skill mismatch. The effect of those varies in the range of –4.6 and –5.1. Unemployment benefit ratio, on the contrary, does not seem to have any significant effect on incentives to work and the possible explanation to that might be relatively low benefit replacement ratios in economies under consideration. Finalising the role of institutional indicators, the absolute dominant factor in determining unemployment rates in CEE-10 economies appear to be labour tax wedge. Active labour market policies, though in much smaller magnitude, is the second one impact factor for unemployment.[35] Macroeconomic controls, accounted by productivity, labour demand and real interest rate shocks, suggest that the overall economic conditions also matter in explaining evolution of unemployment rates. The most plausible conclusion in regard to significance of the real interest rate shock in estimations is that the effect of the real interest rate on capital accumulation is not limited only for the short-run; the effect might be protracted in time, having longer-lasting impact on demand for labour. Contrarily, the effect of productivity shock, even though non-robust, in many representations appears to be statistically insignificant.[36] This would point towards general conclusion of quick expectation and wage adjustment to the decline in productivity growth under unfavourable economic conditions.[37] Increase in labour demand expectedly exerts a strong positive impact on unemployment rate in CEE-10 labour markets. This result thereby implies that increase in labour share, along with decrease in real interest rate, is among one of the most crucial non-institutional factors that might bring unemployment rates down, though labour market institutions, in particular labour tax wedge, appear to over-dominate considerably the impact of these shocks on unemployment. Lastly, inclusion of the lagged dependent variable affects little results from the baseline equation, as accounted by GMM estimates in column 4.

Redefinition of majority of structural indicators as accounted by estimates of columns (5)–(6) of Table 1 affects results of the baseline equation, however, mainly the magnitude of the impact, but not significance of the estimated coefficients. In these models the impact of the tax wedge on unemployment rate is considerably lower compared to the results from the baseline equation, especially in the model where macroeconomic controls are replaced with the single output gap variable. The variable related to the active labour market policies, redefined into public spending on ALMP per unemployed person as a share of GDP per capita, appears to have significant positive impact on labour demand, the same as in the baseline equation. Net replacement rate appears to be statistically insignificant; these results are again in line with the estimates obtained by the baseline equation.

5.2 Special chapter: the effect of minimum wages on unemployment

A special reflection over how minimum wages affect unemployment outcomes is given as well. Augmenting the baseline model with the minimum wage and estimating it, points toward conclusion that minimum wages does not have significant impact on unemployment rates in CEE-10 economies. That is accounted by insignificant coefficient for the minimum wages in equations presented in columns (1) and (4) of Table 2. These findings might feature the fact that such circumstances as reasonable minimum to average wage ratio, right timing for the minimum wage increase or low coverage of the minimum wage receivers also matter to show negligible effect of the minimum wages on labour market outcomes. Also, support for theoretical consideration that in the presence of minimum wages in economies, labour tax wedge might exert additional resistance is not found in this study. Estimation of the models with interaction between minimum wages and labour tax wedge, those results are presented in columns (2), (3) and (5) of the same table, shows insignificance of the estimated interaction term. Inclusion of the minimum wage and its interaction with labour tax wedge in estimations, thereby, does not provide any additional information of how the effect of the labour tax wedge on unemployment rate changes in the presence of the minimum wages.

[35] The dominance is evaluated by calculating the product of each estimated coefficient from the regression and values of relevant explanatory variable.

[36] Replacement of this variable into change in the productivity growth or lagged value of its growth does not change the general conclusion.

[37] Some papers analysing wage rigidity on firm level data, finds the evidence that it might be present in CEE-10 economies under certain types of labour market institutions (Babecky et al. 2009). These findings however do not relate wage rigidity to the productivity shock.

Table 2. Unemployment equation with minimum wages, 2002–2012

	(1)	(2)	(3)	(4)	(5)
	Panel individual and time–specific fixed-effects	Panel individual and time-specific fixed-effects	GMM Arellano-Bond one-step estimator	Panel individual-specific fixed-effects	Panel individual-specific fixed-effects
	Static model: with minimum wage	Static model: with minimum wage and its interaction with labour tax wedge	Dynamic model: with minimum wage and its interaction with labour tax wedge	Static model: gap version with minimum wage	Static model: gap version with minimum wage and its interaction with labour tax wedge
Unemployment rate (-1)			0.12 (0.14)		
Labour tax wedge	0.31 (0.10)***	0.30 (0.11)***	0.34 (0.19)*	0.20 (0.11)*	0.20 (0.11)*
Minimum wage	0.08 (0.06)	0.06 (0.08)	0.16 (0.12)	0.00 (0.05)	–0.04 (0.06)
Labour tax wedge * Minimum wage		–0.03 (0.04)	–0.05 (0.06)		–0.05 (0.06)
Unemployment benefit ratio – 1st year of unemployment	–0.02 (0.04)	–0.02 (0.04)	0.03 (0.06)		
Net replacement ratio				0.05 (0.09)	0.04 (0.09)
Active labour market policies	–4.82 (1.92)**	–4.99 (1.99)**	–5.89 (2.24)**		
Active labour market policies (alt)				–0.25 (0.06) ***	–0.27 (0.06)***
Labour demand shock	–1.35(0.28)***	–1.36 (0.29)***	–1.50 (0.26)***		
Productivity shock	–0.07 (0.10)	–0.07 (0.10)	–0.10 (0.06)		
Real interest rate shock	0.08 (0.04)**	0.08 (0.04)**	0.03 (0.03)		
Output gap				–0.38 (0.03)***	–0.39 (0.03)***
Trend				0.26 (0.07)***	0.25 (0.07)***
Fixed effects	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	no	no
R-squared	0.92	0.92		0.91	0.92

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels respectively; Cross–section (PCSE) standard errors are used to control for panel heteroscedasticity; Necessity for individual specific fixed-effects and time-specific fixed-effects, if included, is tested with redundancy test in models (1)–(2); In static models (1) and (2) country specific trends for Poland, Slovakia and Czech Republic are included in estimations. These account for country specific unidentified shocks, are used for residual correction and chosen due to their significance in equations; In gap version models (4) and (5) a linear trend has been added to the estimations. It captures common unobservable shocks for all countries with similar pass through effect on unemployment rate (Orlandi 2012); For any interaction terms included, both variables are expressed as their deviations from country-specific sample means (Bassanini and Duval 2006; Nickell *et al*. 2002); In difference GMM Arellano–Bond one step estimator procedure lagged endogenous variable in levels and all explanatory variables are used as instruments in estimation.

5.3 The effect of interactions between labour market structural indicators on unemployment

As opposed to the case of minimum wages, interactions between some other labour market institutions appear to play an important role in explaining evolution of unemployment rate in CEE-10 economies. Results of the models with such interactions are presented in Table 3. In this table, column (1) presents results of the augmented equation where labour tax wedge is interacted with active labour market policies, whereas column (2) reports results of the model where unemployment benefit ratio for the first year of unemployment is replaced with two other structural labour market indicators, in particular with net replacement ratio and eligibility period to receive unemployment benefit, in addition, considering interaction between those. In column (3) the possible interdependence between active labour market policies and unemployment benefit ratio is lastly tested.

The main reflection over results appearing in column (1) of Table 3 is that interaction between labour tax wedge and active labour market policies appear to play a role for labour market outcomes. The negative significant coefficient of the interaction term attains interpretation that for higher governments' outlay into active labour market policies, the impact of the tax wedge on unemployment diminishes. Although it is usually considered that increase in the spending for the active labour market policies is financed by taxes and, thereby, might lead to the increase tax wedge, the evidence found here suggest somewhat different implication. Results in this particular case point towards conclusion that active labour market policies are effective and causes decrease in non-wage costs for employers. That, thereby, lessens the impact of higher production wage on demand for labour and unemployment originating from the tax wedge resistance.

Table 3. Unemployment equation with interactions, 2002–2012

	(1)	(2)	(3)
	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects
	Static model: with interaction between labour tax wedge and active labour market policies	Static model: with interaction between net replacement rate and unemployment benefit duration	Static model: with interaction between active labour market policies and unemployment benefit ratio
Labour tax wedge	0.28 (0.10)***	0.27 (0.12)**	0.29 (0.11)**
Unemployment benefit ratio – 1st year of unemployment	–0.01 (0.04)		–0.02 (0.05)
Net replacement ratio		–0.05 (0.11)	
Unemployment benefit duration		0.14 (0.17)	
Active labour market policies	–7.67 (3.27)***	–4.71 (2.30)**	–4.17 (2.34)*
Active labour market policies (alt)			
Labour demand shock	–1.23 (0.20)***	–1.23 (0.20)***	–1.23 (0.20)***
Productivity shock	–0.07 (0.08)	–0.08 (0.07)	–0.08 (0.07)
Real interest rate shock	0.10 (0.04)***	0.08 (0.04)**	0.09 (0.04)**
Net replacement ratio * Unemployment benefit duration		0.04 (0.03)	
Labour tax wedge* Active labour market policies	–2.37 (1.27)**		
Active labour market policies* Unemployment benefit ratio – 1st year of unemployment			–0.09 (0.23)
Fixed effects	yes	yes	yes
Time effects	yes	yes	yes
R-squared	0.92	0.92	0.92

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels respectively; Cross-section (PCSE) standard errors are used to control for panel heteroscedasticity; Necessity for individual specific fixed-effects and time-specific fixed-effects, if included, is tested with redundancy test in models (1)–(3); In static models (1), (2) and (3) country specific trends for Poland, Slovakia, Czech Republic as well as common trend for the Baltic States are included in estimations. These account for country specific unidentified shocks, are used for residual correction and chosen due to their significance in equations; For any interaction terms included, both variables are expressed as their deviations from country-specific sample means (Bassanini and Duval 2006; Nickell *et al*. 2002)

The other hypotheses tested, those results appear in columns (2) and (3) do not find empirical support that interactions between labour market structural indicators matter. Eligibility to receive unemployment benefits period along with its interaction with net replacement ratio does not appear to play significant role for unemployment. Although the signs of the estimates support the theory that longer eligibility period to receive unemployment benefits might strengthen the negative impact of net replacement ratio on unemployment outcomes, altogether, relative ungenerous benefit replacement systems in economies under consideration does not seem to have significant impact on incentives to work. Higher investment into active labour market policies theoretically might be expected to reduce the adverse impact of unemployment benefit ratio on unemployment by making job taking more attractive, but the results, however, do not point towards statistically significant impact, again, mainly due to in general ungenerous benefit replacement systems in these economies.

5.4 The effects of EPL and union density on unemployment

Restricted data on the variables representing union density, index representing coordination in wage setting process and EPL index was the main reason that these variables did not appear in the baseline model. Nevertheless their effects on unemployment are tested in additional representations, but small sample results notably should be treated with high precaution. Results from these models are presented in Table 4. Column (1) presents results of the impact of employment protection legislation on unemployment. Column (2) reports estimates with the variable representing level of unionisation in economies. In column (3) in addition to union density, index representing coordination in the wage bargaining process along with the interaction between these two terms appear in estimations. Finally, column (4) reports results from the equation where union density is interacted with labour tax wedge.

The evidence that employment protection legislation has impact on unemployment in CEE-10 economies is not found in this study. This model also lacks stability and does perform well as it is estimated on extensively reduced sample.

Table 4. Unemployment equation with EPL and union density, 2002–2012

	(1)	(2)	(3)	(4)
	Panel individual and time-specific fixed-effects	Panel individual and time–specific fixed-effects	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects
	Static model: with EPL and interaction between EPL parts	Static model: with union density	Static model: with union density, coordination and their interaction	Static model: with union density and interaction with labour tax wedge
Labour tax wedge	0.26 (0.09)***	0.37 (0.10)***	0.27 (0.10)**	0.36 (0.14)**
Unemployment benefit ratio – 1st year of	0.02 (0.05)	– 0.06 (0.06)	0.01 (0.06)	–0.05 (0.07)
Active labour market policies	–4.95 (2.17)**	–6.43 (4.68)**	–4.61 (2.70)	–6.51 (3.07)**
Union density		0.28 (0.12)***	0.27 (0.08)***	0.28 (0.09)***
Coordination			–0.57 (0.32)*	
Union density * Coordination			–0.30 (0.10)***	
EPRC	–0.38 (1.94)			
EPT	–0.60 (2.74)			
EPRC * EPT	–16.50 (10.35)			
Union density * Labour tax wedge				0.00 (0.05)
Labour demand shock	–2.26(0.31)***	–0.86 (0.23)***	–0.86 (0.13)***	–0.85 (0.14)***
Productivity shock	0.00 (0.06)	–0.03 (0.07)	–0.02 (0.05)	–0.03 (0.06)
Real interest rate shock	0.03 (0.02)*	0.05 (0.04)**	0.05 (0.02)**	0.05 (0.03)*
Fixed effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
R-squared	0.98	0.98	0.98	0.98

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels respectively; Cross–section (PCSE) standard errors are used to control for panel heteroscedasticity; Necessity for individual specific fixed-effects and time-specific fixed-effects, if included, is tested with redundancy test in models (1)–(4); In models (2), (3) and (4) country specific trends for Poland, Slovakia and Czech Republic as well as common trend for the Baltic States are included in estimations. For model (1) country specific trends for Czech Republic and common trend for the Baltic States are included in estimations. These account for country specific unidentified shocks, are used for residual correction and chosen due to their significance in equations; For any interaction terms included, both variables are expressed as their deviations from country-specific sample means (Bassanini and Duval 2006; Nickell *et al.* 2002).

On the contrary, several conclusions could be drawn when variable representing union density is considered in the estimations. The effect of level of unionisation on labour market outcomes is significant and varies around 0.27–0.28 in all specifications, implying that higher union coverage should be usually associated with higher unemployment rates. But, higher coordination in wage bargaining process, as accounted by results in column (3), as expected, has positive effects on employment; this effect is captured by the negative sign of the index representing coordination in wage bargaining process. Interaction term between these two indicators also appears to be negative, indicating that the effect of union density on unemployment weakens for higher coordination in the wage bargaining process. All these results are in line with economic theory and do not contradicts findings that productivity shock appears to have no significant impact on unemployment in CEE-10 economies. Even in the presence of the trade unions, slowdown in productivity growth could be accompanied with quick wage adjustment to the new economic environment. Also, in those CEE-10 economies where level of unionisation is high, union density, together with labour wedge, appear to be among the dominant factors in determining unemployment rates. Lastly, no evidence is found that union density causes tax wedge rigidity as accounted by insignificant coefficient for the interaction term between union density and labour tax wedge. These results are somewhat disappointing, as no additional insights could be provided in this study about the source of labour tax wedge resistance.[38]

5.5 Case study: identifying Lithuania – results from the reduced equations

A special chapter in this paper is given to one of the CEE-10 economies, namely, Lithuania. In particular, it is aimed to evaluate if there is any significant difference in institutional factors affecting unemployment rate in Lithuania and the rest of CEE-10 economies.[39] Results of the reduced static equations are reported in Table 5 with general conclusion that the

[38] These results although would suggest that union density should be associated with overall too high wages whereas tax wedge rigidity could arise from the strong individual bargaining power of employees.

[39] In order to test for this, reduced static models are estimated. Here unemployment rate is regressed on the single labour market structural indicator with slope dummy variables $u_{it} = \beta_j X_{it}^j D^{Lithuania} + \beta_j X_{it}^j D^{Others} + \sum_j X_j Z_{it}^j + \alpha_i + \lambda_t + \varepsilon_{it}$ where $D^{Lithuania}$ is equal to 1 for Lithuania and 0 otherwise and D^{Others} is equal to 0 for the Lithuania and 1 otherwise.

same structural indicators explain the evolution of unemployment rate in Lithuania as in the remaining economies. In addition, no structural indicators display any systematic difference in this country compared to the rest of economies.[40]

Table 5. Unemployment equation, 2002–2012

	(1)	(2)	(3)	(4)
	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects	Panel individual and time-specific fixed-effects
	Reduced static model: with labour tax wedge only	Reduced static model: with net replacement rate only	Reduced static model: with active labour market policies (alt) only	Reduced static model: minimum wages only
Labour tax wedge*Lithuania	0.44 (0.20)**			
Labour tax wedge* Others	0.21 (0.09)**			
Net replacement rate* Lithuania		0.06 (0.07)		
Net replacement rate* Others		0.51 (0.33)		
Active labour market policies (alt) * Lithuania			–0.21 (0.08)***	
Active labour market policies (alt) * Others			–0.25 (0.10)***	
Minimum wage * Lithuania				0.09 (0.21)
Minimum wage * Others				0.09 (0.06)
Labour demand shock	–1.43 (0.15) ***	–1.34 (0.20) ***	–1.46 (0.25) ***	–1.38 (0.26)***
Productivity shock	–0.06 (0.07)	–0.06 (0.08)	–0.08 (0.11)	–0.07 (0.10)
Real interest rate shock	0.08 (0.03)**	0.08 (0.03)**	0.04 (0.03)	0.06 (0.04)*
Fixed effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
R-squared	0.90	0.93	0.90	0.89

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels respectively; Cross–section (PCSE) standard errors are used to control for panel heteroscedasticity; Necessity for individual specific fixed-effects and time-specific fixed-effects, if included, is tested with redundancy test in models (1)–(4); Country specific trends for Poland, Slovakia and Czech Republic are included in estimations. These account for country specific unidentified shocks, are used for residual correction and chosen due to their significance in equations.

5.6 Comparison of results to the other studies

In this section results of this study for CEE-10 economies are compared to the similar studies analysing unemployment problems in EU-13 member states as well as OECD-21 economies. These particular studies are chosen for comparison because of two main reasons – firstly, these employ same estimation techniques and, secondly, majority of labour market structural indicators for CEE-10 are defined identically as in those studies.[41] Table 6 summarises results and leads to the several basic insights.

Table 6. Comparing results with studies for EU-13 and OECD-21 countries

	Results of this study Method: Panel individual and time-specific fixed-effects Sample: CEE-10 All coefficients from the baseline equation	**Orlandi (2012)** Method: Panel individual and time-specific fixed-effects Sample: EU-13	**Bassanini and Duval (2006)** Method: Panel individual and time-specific fixed-effects Sample: OECD-21
Labour tax wedge	0.35 to 0.49 (*)	0.26 to 0.33 (*)	0.25 (*)
Total tax wedge	#NA	#NA	0.15 to 0.31 (*)
Unemployment benefit ratio – 1st year of unemployment	–0.02	#NA	0.09
Net replacement ratio	–0.01 to 0.04	0.02–0.10 (*)	0.04 to 0.13 (*)
Active labour market policies	–5.06 to –4.56 (*)	#NA	#NA
Active labour market policies (alt)	–0.25 to –0.28 (*)	–0.06 to –0.04 (*)	–0.03 (*)
Union density (**)	0.26–0.28 (*)	0.09 to 0.13 (*)	0.06 (*)

(*) denotes significant coefficients; (**) denotes alternative, not baseline, model results

Majority of labour market structural indicators tend to have higher impact on unemployment in CEE-10 economies, yet, the estimates obtained by this study appear to be directly comparable with the results for EU-13 and OECD-21 countries.

[40] If there are differences in the magnitudes of estimates are tested with Wald tests. Results of the test do not indicate any systematic differences between estimates for Lithuania and for remaining economies for any structural indicator.

[41] Even though the study of EU–13 member states evaluates determinants of NAWRU in the baseline equation, the model used for robustness check reports results on the actual unemployment rate.

In particular, the impact of the labour tax wedge on unemployment rate is just somewhat higher in CEE-10 economies, but the magnitude of the estimates on the active labour market policies and union coverage indicates that these tend to have much greater effect on demand for labour. However, as CEE-10 economies, are in general exposed to higher level of the long run and annual unemployment rates as well as higher overall volatility of economic activity, these results are considered to seem plausible if compared to EU-13 and OECD-21 countries. In regard to unemployment benefit ratio, it appears to be an important indicator for unemployment in EU-13 and OECD-21 countries, but not in CEE-10 economies. The basic explanation for that, as already noted in the previous sections, is apparently relatively low unemployment benefit ratios in the latter group of countries as well as, overall, less generous unemployment benefit systems (in terms of period of entitlement to receive benefits and coverage of the system).

6. Conclusions and policy implications

This paper provided evidence that labour market institutions matters in explaining unemployment rates in the set of the Central and Eastern European economies. These results are of importance from the policy-making perspective aiming to bring unemployment rates down in these economies. In this study, it appeared that reduction in the labour tax wedge and increase in spending on the labour market policies has significant positive effects on the labour market outcomes. The evidence that unemployment benefit ratio tends to have impact on the unemployment, on the contrary, is not found here. From the policy-making perspective, the latter result would suggest that policies to keep relatively low unemployment benefit ratios (along with short eligibility period to receive benefits) should be preserved in order for these not to be disincentive for job taking and not to exert excess pressure on wage claims. The adverse effect of the union power on unemployment could be considerably reduced by increase in the degree of coordination in the wage bargaining process, or, more generally, complementarity in labour market reforms is advisable to lessen the impact of the adverse labour market institutions on unemployment rate. Macroeconomic shocks also appear to play important role in explaining unemployment outcomes. The main policy implication from these results would be that increase in overall labour market flexibility is required to bring unemployment rates down as it would allow quicker adjustment of the CEE-10 labour markets to unfavourable changes in economic environment.

References

Babecky, J., Du Caju, P., Kosma, T., Lawless, M., Messina, J. and Room, T. (2009), "Downward Nominal and Real Wage Rigidity. Survey Evidence from European Firms". *ECB Working Paper Series* No. 1105.

Baccaro, L., Rei, D. (2007), "Institutional Determinants of Unemployment in OECD Countries: Does the Deregulatory View Hold Water?". *International Organisation,* Vol. 61(3) (Summer, 2007), pp. 527–569.

Ball, L. (1999), "Aggregate Demand and Long–Run Unemployment". *Brookings Papers on Economic Activity*, Vol. 1999, No.2 (1999), pp.189–251.

Bassanini, A. and Duval, R. (2006), "Employment Patterns in OECD Countries: Reassessing the Role of Policies and Institutions". *OECD Economic Department Working Paper* No. 486.

Bertola, G., Blau, F., Kahn, L. (2001), "Comparative Analysis of Labour Market Outcomes: Lessons for the US from International Long Run Evidence". *NBER Working Paper Series* No. 8526.

Blanchard, O., Wolfers, J. (2000), "The Role of Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence". *The Economic Journal,* Vol. 110(462), pp. C1–C33.

Borghijs, A., Ederveen, S. and Mooij, R. (2003), "European Wage Coordination: Nightmare or Dream to Come True?". *CPB Discussion Paper,* No. 017, March 2003.

Chung, Y., Jeong, J., (2008), "Analysis of Employment Protection Laws and Unemployment Benefits". *Economics Letters* 99 (2008), pp. 144–146.

Cunado, J. and Alberiko, G. (2012), "Unemployment Hysteresis: Empirical Evidence for Latin America". *Journal of Applied Economics.* Vol. 15(2) (November 2012), pp. 213–233.

D'Auria, F., Denis, C., Havik, K., McMorrow, K., Planas, C., Raciborski, R., Werner, R. and Rossi, A. (2010), "The Production Function Methodology for Calculating Potential Growth Rates and Output Gaps". *EC Economic Papers* 420. July 2010.

Forslund, A. and Kolm, A. (2000), "Active Labour Market Policies and Real-Wage Determination". IFAU — Institute for Labour Market Policy Evaluation, Working Paper Series 01/2000.

Holmlund, B. (1998), "Unemployment Insurance in Theory and Practice". *Scandinavian Journal of Economics* 100(1), pp. 113–141.

Lauringson, A. (2010), "Disincentive Effects of Unemployment Insurance Benefits: Maximum Benefit Duration Versus Benefit Level". *The University of Tartu Faculty of Economics and Business Administration.* Working Paper No. 70, 2010.

Martin, J. and Grubb, D. (2001), "What Works and for Whom: A Review of OECD Countries' Experiences with Active Labour Market Policies". Swedish Economic Policy Review 8 (2001), pp. 9–56.

Nickell, S. (1997), "Unemployment and Labour Market Rigidities: Europe Versus North America". *Journal of Economic Perspectives,* Volume 11(3), pp. 55–74.

Nickell, S., Nunziata, L., Ochel, W. and Quintini, G. (2002), "The Beveridge Curve, Unemployment and Wages in the OECD from the 1960s to the 1990s" Centre for Economic Performance, London School of Economics and Political Science, London, UK.

Nickell, S., Nunziata, L. and Ochel, W. (2005), "Unemployment in the OECD Since the 1960s. What Do We Know?". *The Economic Journal,* 115 (January), pp. 1–27.

Orlandi, F. (2012), "Structural Unemployment and its Determinants in the EU countries". *EC Economic Papers 455.* May 2012.

Saint-Paul, G. (2004), "Why are European Countries Diverging in their Unemployment Experience?". *Journal of Economic Perspectives,* Vol. 18, No.4, Fall 2004, pp.49–68.

Stovicek, K. and Turrini, A. (2012), "Benchmarking Unemployment Benefit Systems". *EC Economic Papers 454.* May 2012.

Venn, D. (2009), "Legislation, Collective Bargaining and Enforcement". *OECD Social, Employment and Migration Working Papers No. 89.*

Word Bank (WB) (2005), "Special Topic: Labour Taxes and Employment in the EU8*". Quarterly Economic Report,* April 2005 Part II.

Young, David (2003), "Employment Protection Legislation: its Economic Impact and the Case for Reform". *EC Economic Papers* 186. July 2003.

Appendix A. Data time series plots and descriptive statistics 2002–2012/2013[42]

Figure A.1. Annual unemployment rates across CEE–10 countries 2002–2013
(measured as a share of unemployed to the labour force, in %)
Sources: Eurostat

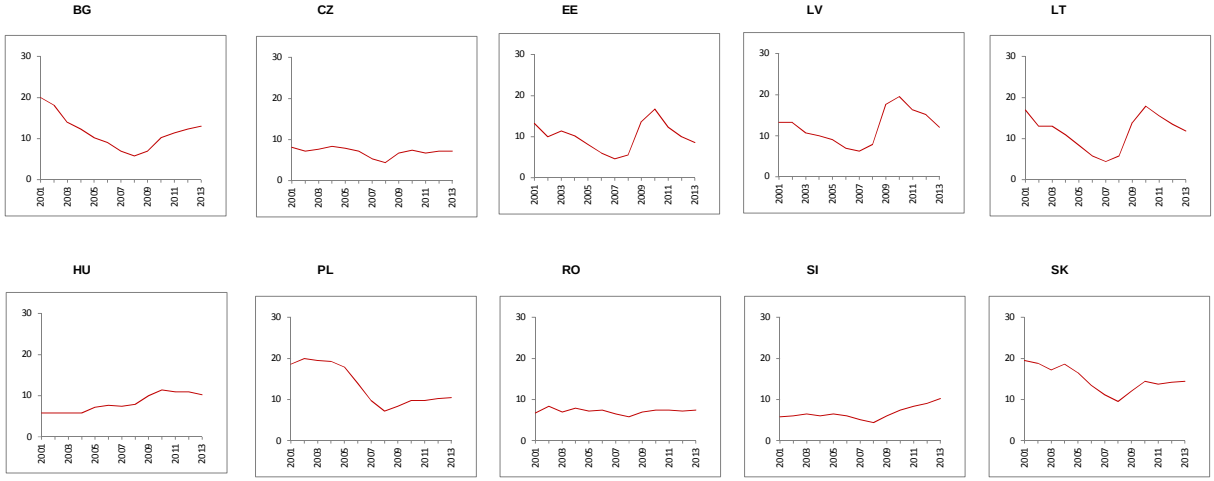
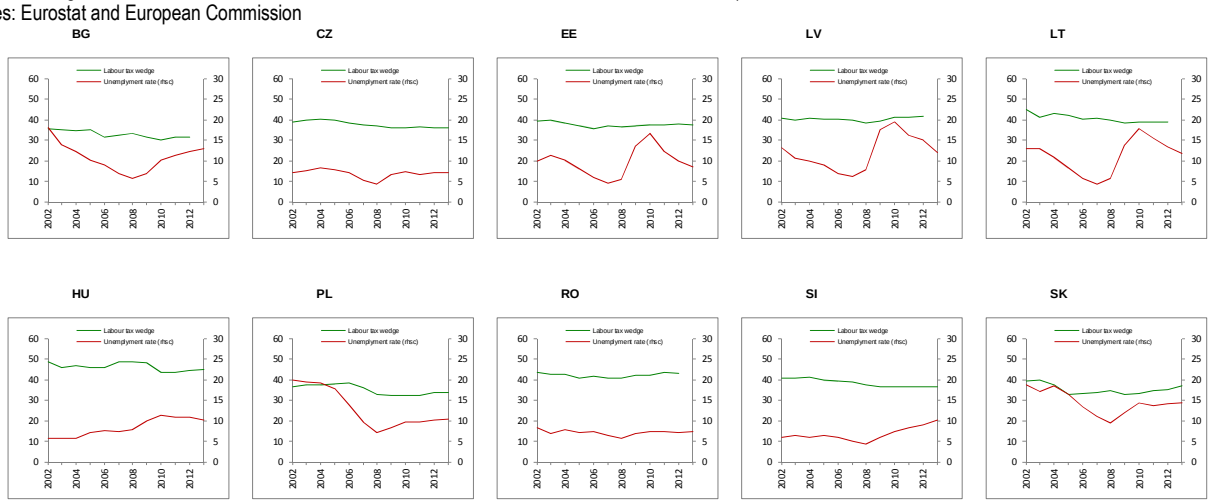


Figure A.2. Labour tax wedge and unemployment rate across CEE–10 countries 2002–2013
(labour tax wedge is measured as a ratio between the sum of labour taxes and total labour costs, in %)
Sources: Eurostat and European Commission



[42] Data cut is of December 2014.

Figure A.3. Unemployment benefit ratio – 1st year of unemployment and unemployment rate across CEE–10 countries 2002–2012
(unemployment benefit ratio – 1st year of unemployment is measured as share of unemployment insurance benefit to previous total gross earnings,in %)
Sources: Eurostat and European Commission

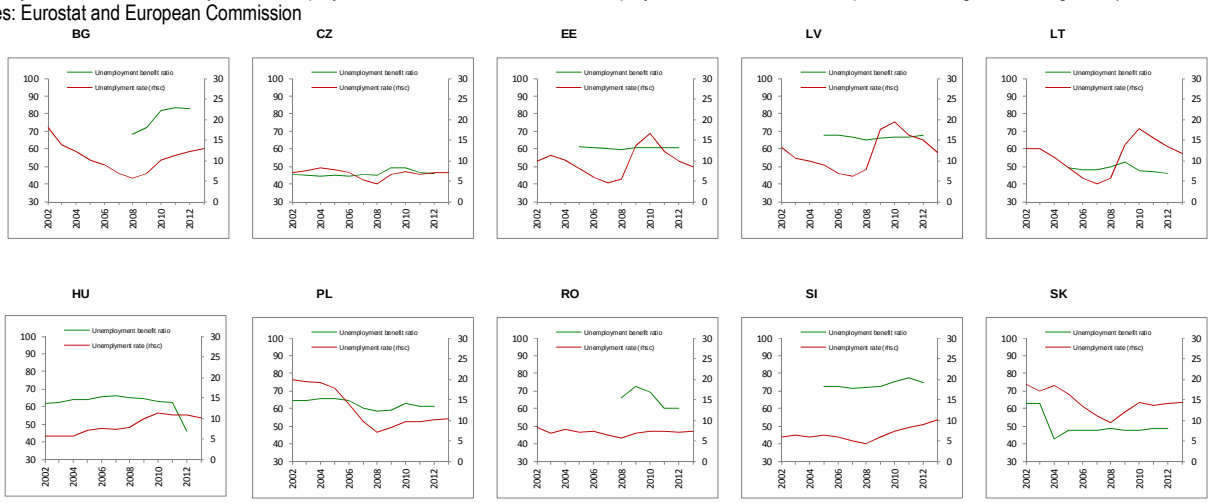


Figure A.4. Active labour market policies to GDP ratio and unemployment rate across CEE–10 countries 2002–2012
(active labour market policies to GDP ratio is measured as public expenditure aggregate on active labour market program as a share of GDP, in %)
Source: Eurostat

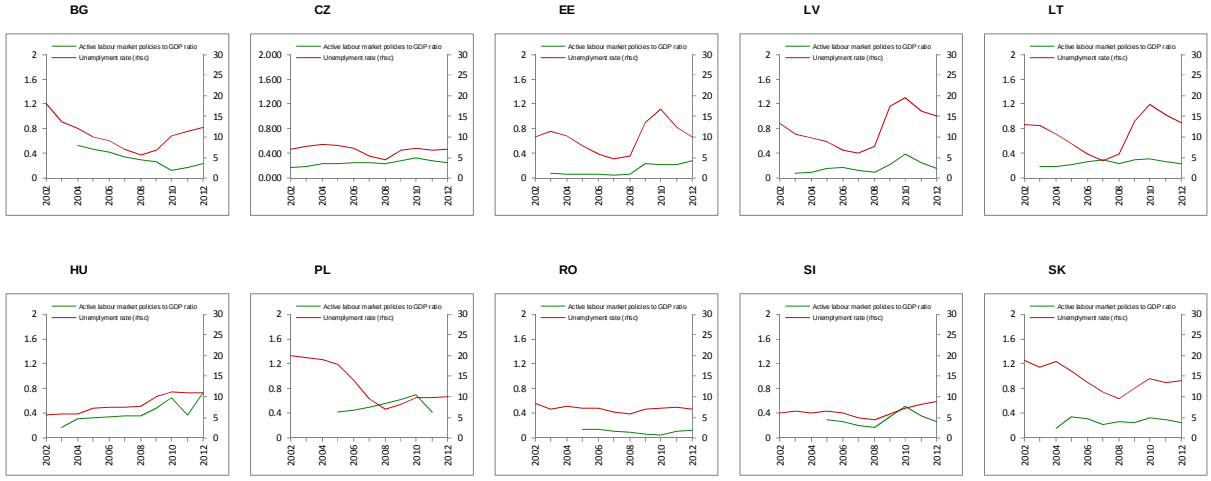


Figure A.5. Deviation from the mean for the employment share in the construction and unemployment rate across CEE–10 countries 2002–2013
(deviation from the mean for the employment share in the construction is measured as a ratio of employees in construction sector to the total employees in economy, deviation from the mean, in %)
Source: Eurostat

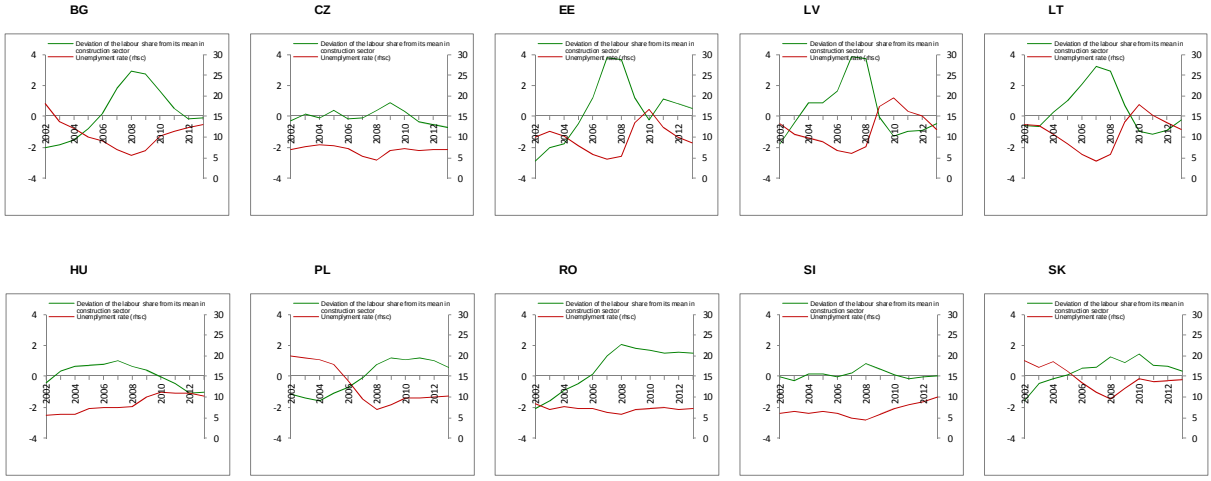


Figure A.6. Labour productivity growth and unemployment rate across CEE–10 countries 2002–2013
(labour productivity growth is measured as annual growth in labour productivity, in %)
Source: Eurostat

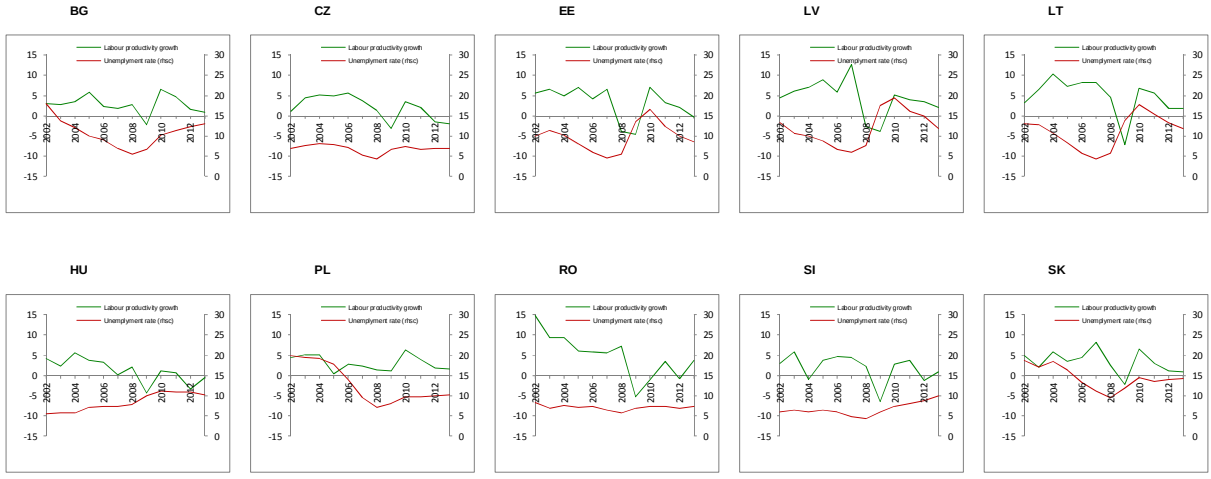


Figure A.7. Real interest rates and unemployment rate across CEE–10 countries 2002–2013
(real interest rates are measured as the difference between nominal long–term government bond yield and annual change in GDP deflator, in %)
Sources: Eurostat and Bank of Estonia

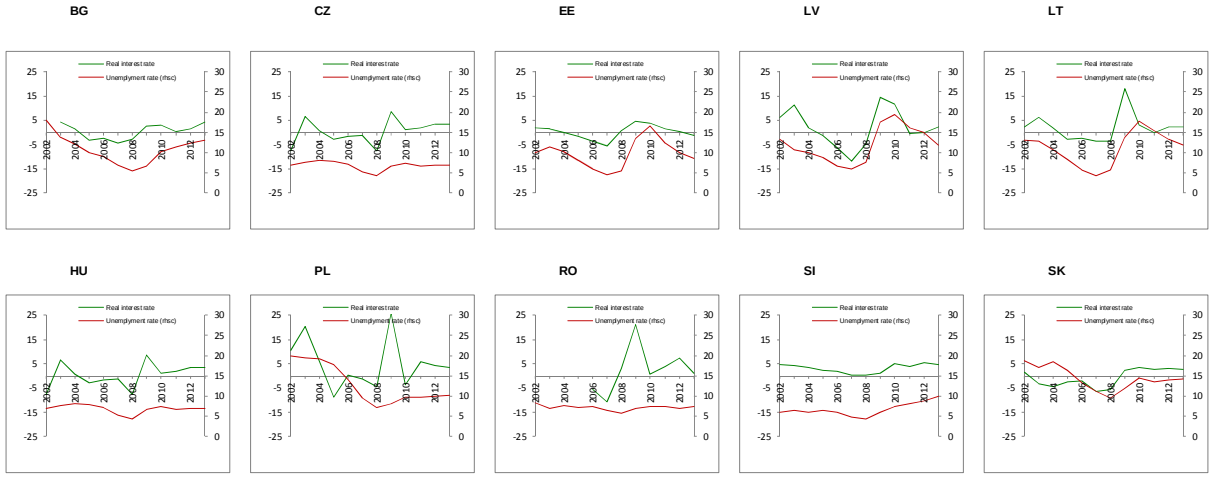


Table A.8. Descriptive statistics for unemployment and selected structural and non–structural indicators, 2002–2012

	Mean	Std. Dev.	Minimum	Maximum	Mean	Std. Dev.	Minimum	Maximum
	Unemployment rate, %				Labour tax wedge, %			
BG	10.56	3.58	5.60	18.10	32.87	2.02	29.99	35.72
CZ	6.85	1.11	4.40	8.20	37.80	1.55	35.98	40.05
EE	9.82	3.66	4.60	16.70	37.59	1.32	35.49	39.96
LV	11.95	4.59	6.10	19.50	40.35	0.94	38.42	41.59
LT	11.02	4.39	4.30	17.80	40.66	2.04	38.40	44.71
HU	8.19	2.18	5.60	11.20	46.25	2.05	43.28	48.77
PL	13.15	5.00	7.10	20.00	35.19	2.54	32.18	38.26
RO	7.11	0.65	5.80	8.30	42.03	0.99	40.61	43.29
SI	6.42	1.32	4.40	8.90	38.59	1.91	36.49	41.23
SK	14.43	2.99	9.50	18.70	35.14	2.46	32.86	39.57
Pooled sample	**9.95**	**4.12**	**4.30**	**20.00**	**38.65**	**4.11**	**29.99**	**48.77**
	Mean	**Std. Dev.**	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
	Unemployment benefit ratio –1 st year of unemployment, %				Active labour market policies to GDP ratio, %			
BG	77.63	7.02	68.10	83.43	0.32	0.13	0.13	0.52
CZ	45.97	1.64	44.62	49.12	0.25	0.04	0.18	0.33
EE	60.56	0.56	59.53	61.37	0.14	0.09	0.05	0.29
LV	66.74	0.87	65.22	67.82	0.18	0.09	0.09	0.39
LT	48.58	2.11	45.93	52.72	0.25	0.04	0.19	0.31
HU	62.16	5.49	46.10	66.02	0.41	0.17	0.17	0.73
PL	62.53	2.51	58.53	65.6	0.52	0.11	0.42	0.69
RO	65.69	5.47	60.07	72.43	0.11	0.03	0.06	0.15
SI	73.54	1.90	71.68	77.23	0.30	0.10	0.18	0.51
SK	47.90	0.48	47.45	48.48	0.28	0.04	0.22	0.34
Pooled sample	**59.77**	**10.37**	**42.70**	**83.43**	**0.27**	**0.15**	**0.05**	**0.73**
	Mean	**Std. Dev.**	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
	Labour productivity growth , %				Real interest rate, %			
BG	2.99	2.37	–2.29	6.56	0.05	2.98	–4.27	4.06
CZ	2.51	2.83	–3.14	5.67	0.11	5.16	–7.73	8.64
EE	3.50	4.15	–4.63	6.95	0.37	3.00	–5.46	4.76
LV	4.67	4.66	–3.82	12.72	1.81	8.32	–11.97	14.30
LT	5.08	4.71	–7.16	10.38	1.90	6.21	–3.73	18.01
HU	1.42	3.04	–4.25	5.56	4.38	6.51	–6.47	17.46
PL	3.19	1.92	0.45	6.36	4.90	10.62	–8.90	26.03
RO	4.95	5.63	–5.24	14.70	2.86	10.14	–10.73	21.20
SI	1.95	3.53	–6.40	5.75	2.99	1.89	0.32	5.60
SK	3.64	2.80	–2.17	8.09	–1.00	3.70	–6.29	3.35
Pooled sample	**3.39**	**3.77**	**–7.16**	**14.70**	**1.81**	**6.38**	**–11.97**	**26.03**

Note: Descriptive statistics for labour demand shock is not reported here. This variable per definition has a zero mean.

Appendix B. Unit root test results 2002–2012

	Levin, Lin & Chu (common unit root)	**Im, Pesaran & Shin** (individual unit roots)
Unemployment rate	–2.91 (*)	–0.83
Labour tax wedge	–3.09 (*)	–0.56
Unemployment benefit ratio –1 st year of unemployment	–34.64 (*)	–7.61 (*)
Active labour market policies to GDP ratio	–3.64 (*)	–1.07
Deviation from the mean for the employment share in the construction	–3.97 (*)	–1.65 (*)
Labour productivity growth	–4.48 (*)	–1.40 (*)
Real interest rate	–4.83 (*)	–1.85 (*)

Notes: Numbers denotes statistics for unit root tests; (*) Denotes rejection of the null hypothesis at the 10% significance level. Even though some tests fail to reject the null hypothesis of the unit root, these results are disregarded as these variables are stationary by construction.